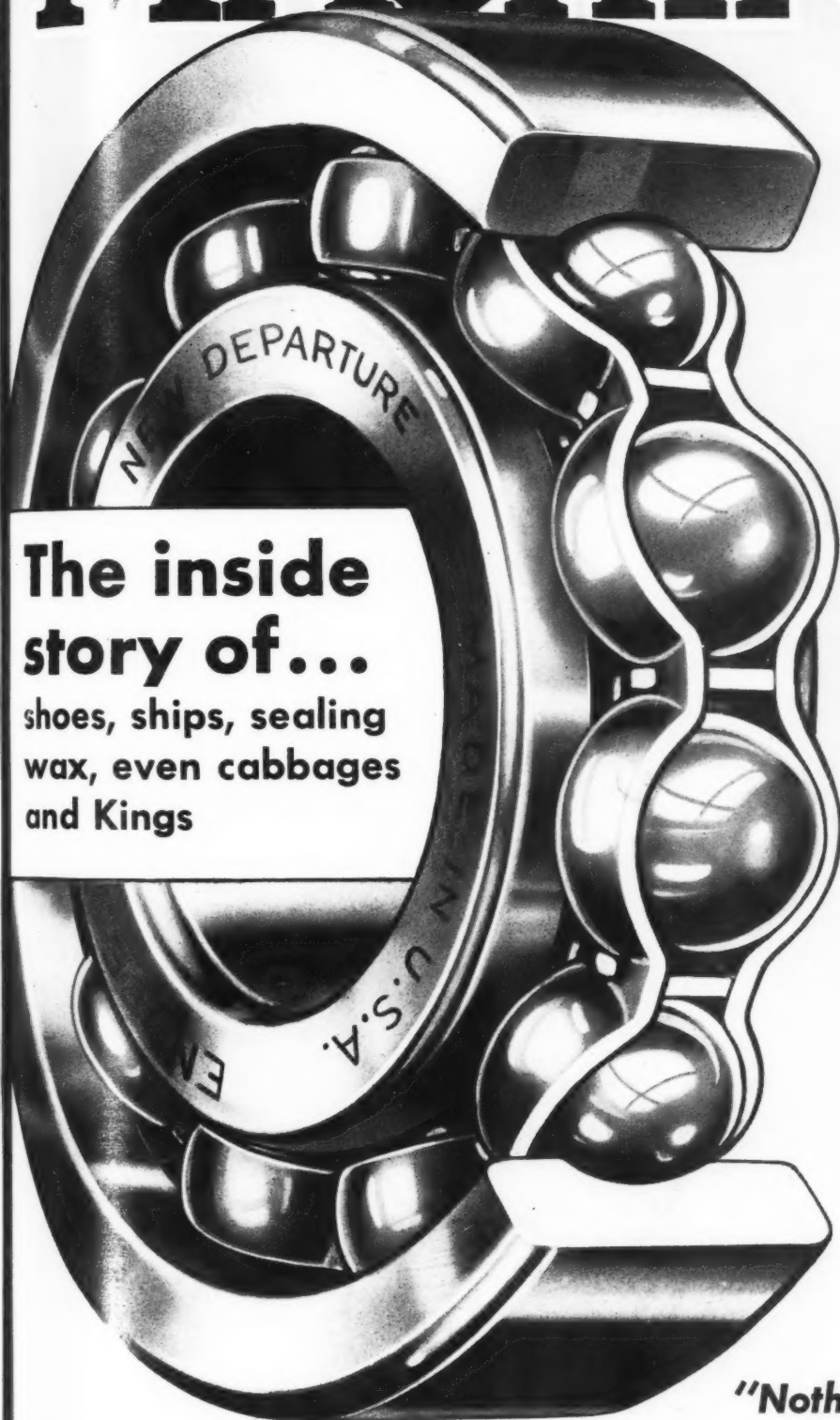


JUNE 1946 — FIFTY-SECOND YEAR

MACHINERY



The inside story of...

shoes, ships, sealing wax, even cabbages and Kings

Most devices which lessen labor or do jobs better have ball bearings in their systems—or in their family trees.

For nothing rolls like a ball—and the ball bearing carries tremendous loads on tough steel balls. Carries them at higher speeds and with greater precision, too.

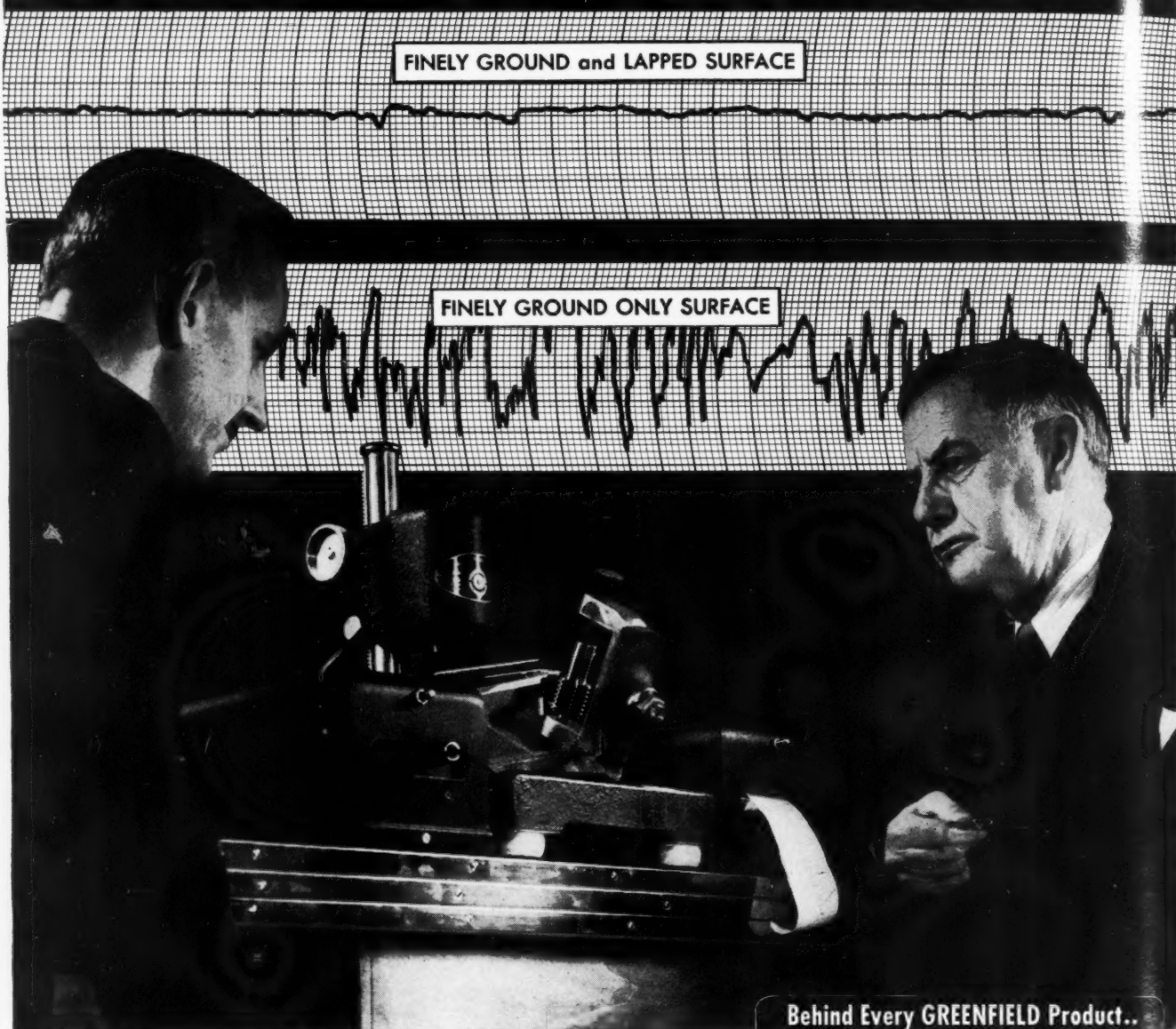
Because of producing better ball bearings—and better engineering ideas—New Departure has become the world's greatest ball bearing maker.

"Nothing rolls like a ball"

NEW DEPARTURE

World's Greatest Ball Bearing Maker

Smoother Surfaces Give Longer Life



All "Greenfield" Gages have finely ground and lapped surfaces. To the casual eye, such surfaces look no different than if ground only. But the graph produced by the Surface Analyzing Machine illustrated above shows this difference clearly. To the gage user, this difference also becomes apparent—in terms of wear. A "Greenfield" Gage will give longer and more accurate service—and therefore better value—because of its finely ground and lapped surfaces.

It's "Greenfield's" attention to such unseen quality factors that give you *more for your money* when you use "Greenfield" Tools and "Greenfield" "Show-How" field service.

GREENFIELD

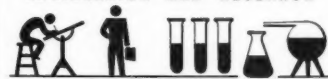
GREENFIELD TAP and DIE CORPORATION
GREENFIELD, MASSACHUSETTS

Behind Every GREENFIELD Product..

LARGEST MANUFACTURING CAPACITY



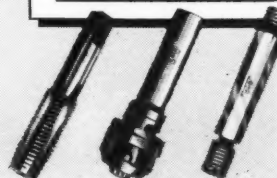
ENGINEERING AND RESEARCH



FIELD SERVICE MEN



LEADING DISTRIBUTORS



MACHINERY

JUNE, 1946

PRINCIPAL CONTENTS OF THIS NUMBER

For Complete Classified Contents, See Page 252

Several years before the war, the Ford Motor Co. developed a unique manufacturing set-up for the production of cylinder sleeves from scrap fender steel. The unusual engineering ideas followed in evolving the manufacturing procedure have made this an ideal production line. The sleeves pass through a series of nine drawing operations, for example, three trimming operations, six washing machines, three annealing furnaces, an automatic storing machine, and several flanging operations, all without being touched by human hands. This unique production line has never been described in the technical press. It will be featured in July MACHINERY. Another article will describe physical characteristics of special alloys developed for prolonged use at temperatures as high as 1500 degrees F.

The Forging of Magnesium	By Arnold L. Rustay and Franklin B. Rote	141
The Hydraulic Circuit in Bending Machines	By E. J. DeWitt and Harry S. Nachman	149
Utilizing Residual Forming Stresses in Flat Steel Springs	By W. C. Troy	152
Surface Grinding with Cylinder and Segmental Wheels	By J. C. Arndt and W. S. Hollowell	158
Present-Day Motor Drives and Other Electrical Equipment for Machine Tools	By G. A. Caldwell	164
Friction Band-Sawing of Hard Materials	By Charles H. Wick	169
Some Considerations in Internal Grinding		172
Coated Abrasives Solve Many Reconversion Metal-Finishing Problems		174
Equipment Designed to Facilitate the Use of Diamond Tools	By Dr. G. Schlesinger and Dr. D. F. Galloway	179
"This is Resistance Welding"—A New General Electric Motion Picture		182
Editorial Comment		186
A User Enumerates Future Requirements for Machine Tools		187
Working Conditions in a Machine Shop Improved by Sound-Conditioning	By Francis A. Westbrook	188
High Impact Values of Steel Castings for Use at Extremely Low Temperatures		190

Volume 52
Number 10



DEPARTMENTS

Engineering News	184
Questions and Answers	192
Ingenious Mechanisms	193
Tool Engineering Ideas	195
Materials of Industry	198
Shop Equipment News	199
New Trade Literature	232
News of the Industry	238
Data Sheet	245

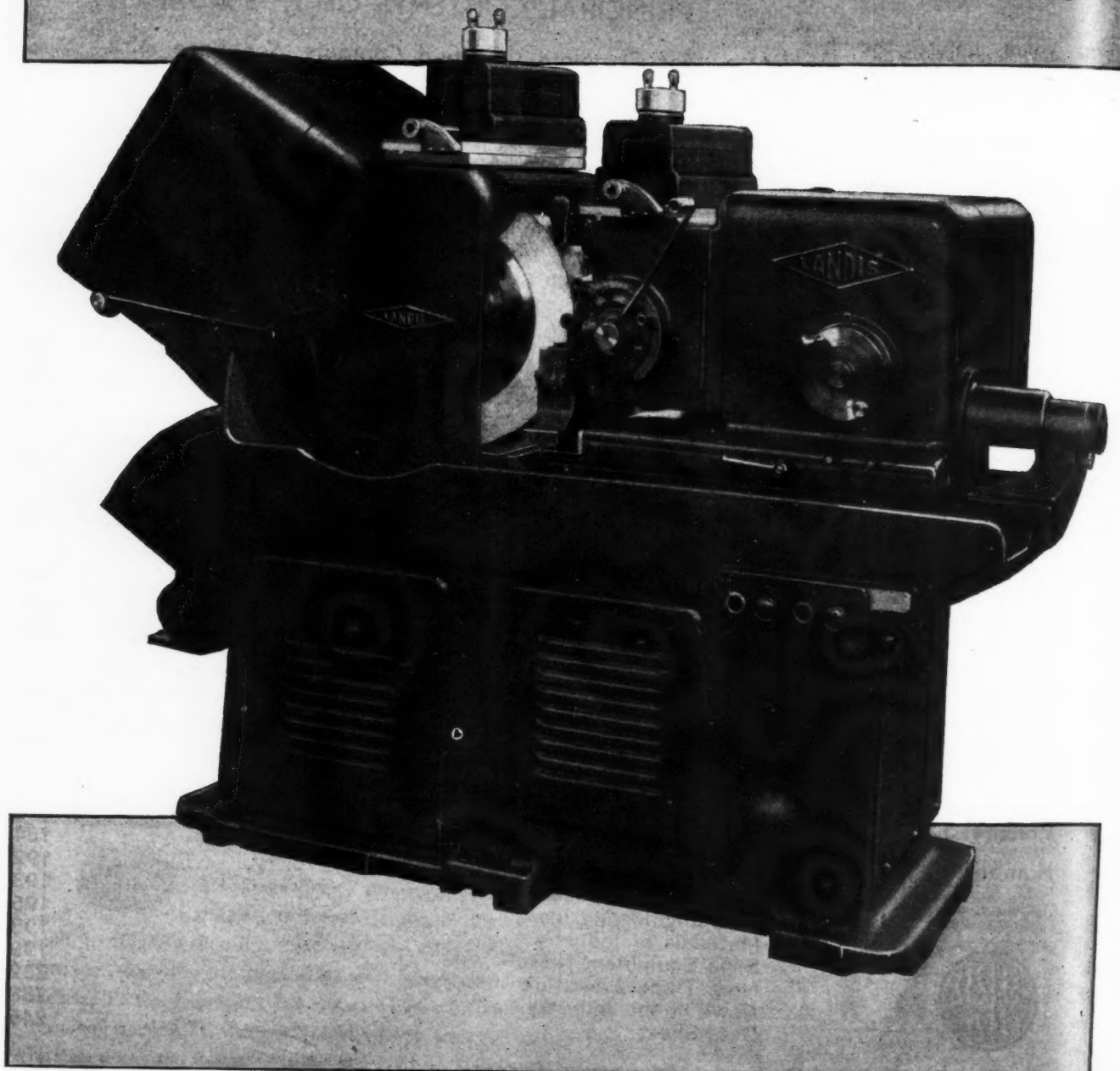
Product Index 432-446
Advertisers Index 449-450

TOTAL DISTRIBUTION
20,625

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette St. New York 13, N. Y.
ROBERT B. LUCHARS *President*
EDGAR A. BECKER *Vice-pres. and Treasurer*
ERIK OBERG *Editors*
FRANKLIN D. JONES
CHARLES O. HERB *Managing Editor*
FREEMAN C. DUSTON *Associate Editor*
HOLBROOK L. HORTON *Associate Editor*
HAROLD L. GRAY *Publishing Manager*
BRIGHTON, ENGLAND:
MACHINERY, 17 Marine Parade

SUBSCRIPTION RATES: United States and Canada, one year, \$4; two years, \$7; three years, \$8; foreign countries, \$7 a year. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address.
Copyright 1946 by The Industrial Press. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.
Member of A.B.P. Member of A.B.C.

The CENTERLESS



LANDIS

THREAD GRINDER

Announced by

LANDIS MACHINE CO. in 1944 . . .

is NOW AVAILABLE

*Reproduction of Advertisements Appearing
in Trade Magazines, January, 1944*

LANDIS MACHINE COMPANY

has acquired Patents relating to
an entirely new and revolutionary

CENTERLESS THREAD GRINDER

from

ALFRED HERBERT, LTD.
COVENTRY - ENGLAND

*This type of grinder has never
been on the market, but
LANDIS MACHINE COMPANY
will be manufacturing it
as soon as the war
is won.*



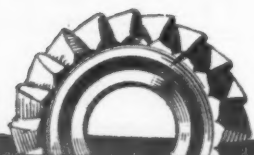
LANDIS MACHINE COMPANY
WAYNESBORO, PA., U. S. A.

A most desirable feature of the
LANDIS Machine Company's
Centerless Thread Grinder is the
ability to thru-feed headless parts
or plunge-cut headed work. This
feature gives the machine a much
wider field of application.

**Write for
Particulars**

**MACHINE CO. WAYNESBORO
PA. U. S. A.**

Clearance .001"



THE FELLOWS METHOD...MACHINES AND TOOLS FOR

1" to .0015"

definitely maintained on the GEAR SHAPER

► AUTOMOTIVE PUMP ROTOR A TYPICAL HIGH-PRECISION JOB

It is a real problem to produce the inner member of this Pump Rotor within the tolerances imposed. It must rotate freely in the mating outer member, yet with such close clearance as to permit pumping oil at pressures up to 100 p.s.i.

Material is a special grade of cast iron having good wearing qualities. Critical considerations are that the contours shall be exactly conjugate to the mating member, and within extremely close dimensional limits.

The job is "a natural" for the 7-Type Gear Shaper. Work is held in a special fixture, and a special cutter provided. The cutting time is 1 1/4 minutes, one piece being cut at a setting. The inherent precision of the machine and cutter holds accuracy under positive control.

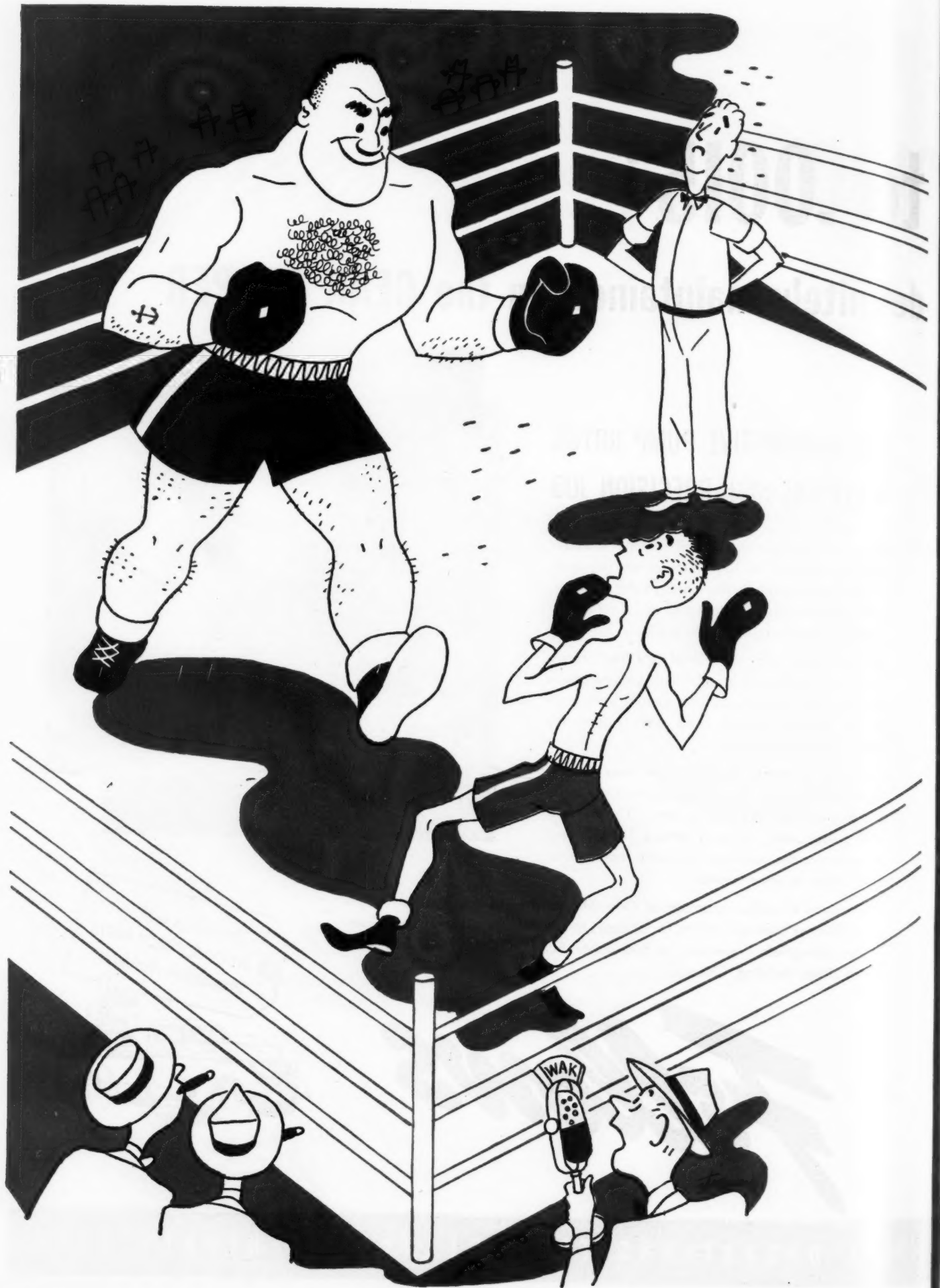
For a study of similar examples of Gear Shaper precision and versatility see "The Fellows Method". Write for a copy, to The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit—or 640 West Town Office Building, Chicago.



Fellows



ALL OPERATIONS FROM BLANK TO FINISHED GEAR



you wouldn't

**match a bantamweight
against a heavyweight**

Nor should you put carbide cutting tools on a lathe lacking the fundamentals for their most efficient use. These cutting tools have increased horsepower requirements 300 per cent and more. They have increased cutting speeds 200 to 500 per cent.

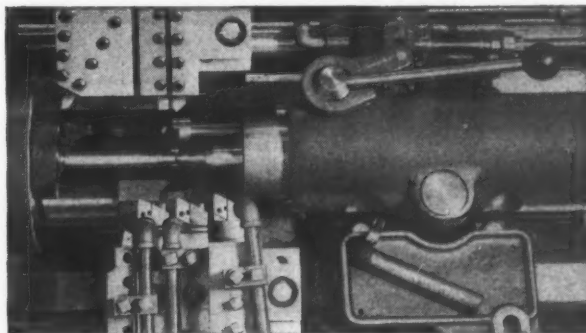
Your profits may well depend upon the efficiency of your turning operations. For instance, in your plant, turning probably accounts for 25 per cent or more of machining time. This could be substantially reduced by the most efficient use of carbide cutting tools, and an important saving in manufacturing cost effected.

It will pay you to check now on the production efficiency of all metal turning equipment in your plant — and to replace it, if need be, with high production war surplus machines or new machines. Jones & Lamson Fay Automatic Lathes and Universal Turret Lathes are designed specifically for the most efficient use of carbide cutting tools.

We are anxious to assist all owners of Jones & Lamson equipment bought from government surplus, to obtain the best possible results from their purchases. Telephone or write to us for complete particulars.

What Horsepower Are YOU Using?

15 horsepower is required to turn and face this small steering rod at the high surface speeds required by the carbide cutting tools. Fay Automatic Lathes are designed specifically for the most efficient use of carbide cutting tools.



Engineered to "Carry the Load" for Most Productive Operation With Carbide Cutting Tools

Fay Automatic Lathes

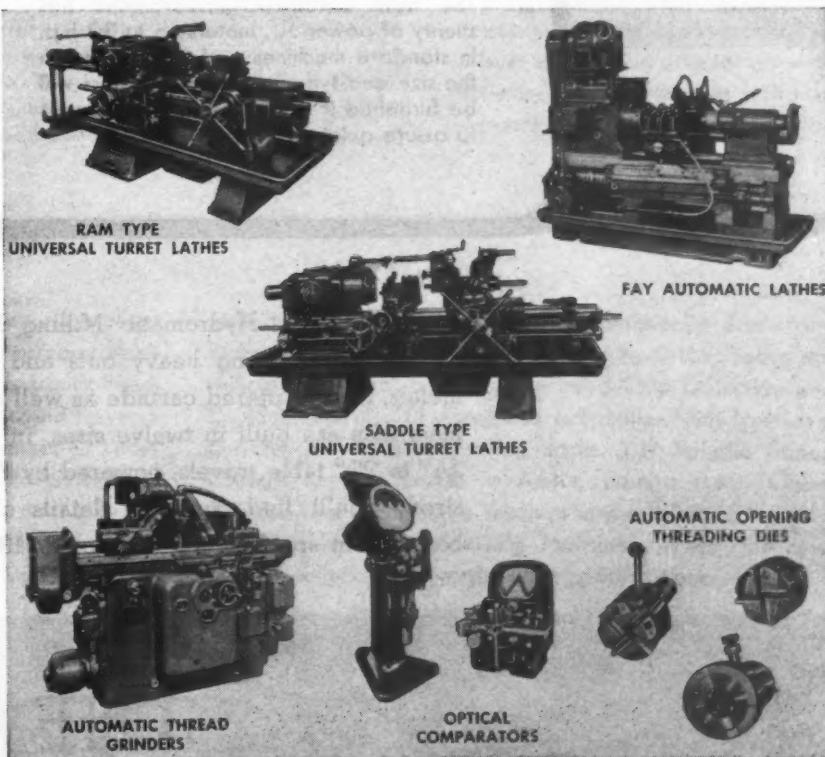
**JONES &
LAMSON**

MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

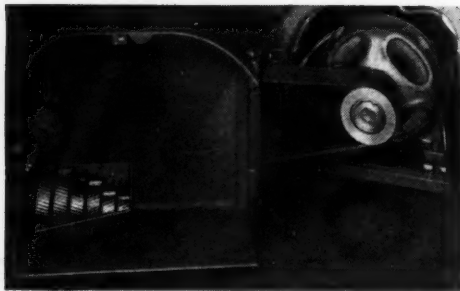


Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

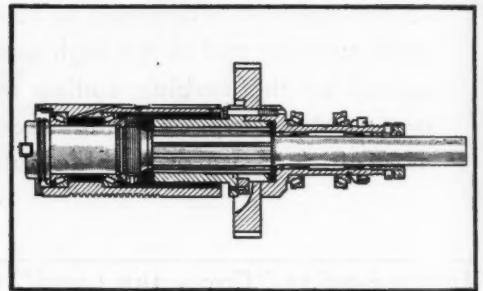


Your profits may well depend upon the efficiency of your turning operations. For reasons in your mind, turning probably accounts for 25 per cent or more of machine tool cost. The Cincinnati Hydromatic is the answer.

The New, Heavier and More Powerful CINCINNATI HYDROMATIC MILLING MACHINES *offer all these features...*



The new CINCINNATI Hydromatic has plenty of power . . . motors up to 30 h.p. in standard machines . . . depending upon the size and type, and larger motors will be furnished if desired. V-belts are used to assure quiet, smooth operation.



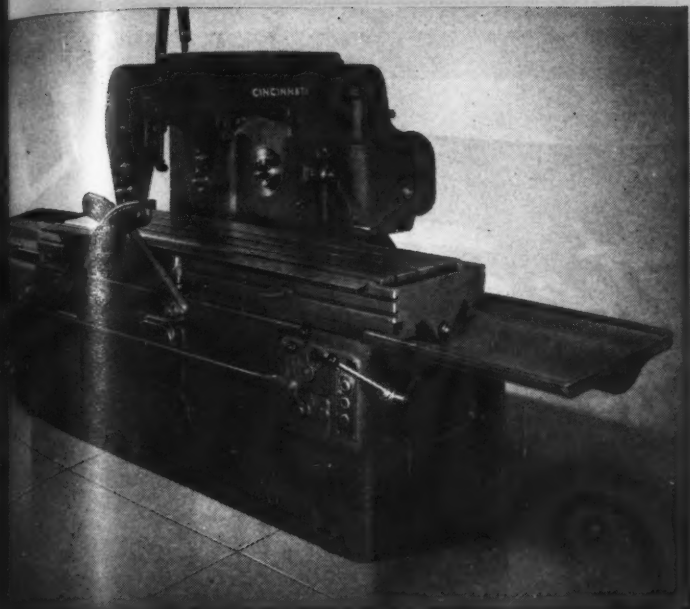
You will notice from the sketch above that the spindle of the new Hydromatic is extra large, and mounted on four anti-friction bearings. The spindle drive is simple, powerful and decidedly efficient, having only four gear contacts.

New CINCINNATI Hydromatic Milling Machines are especially adaptable to operations requiring heavy cuts and rapid metal removal on all types of metals, using sintered carbide as well as high speed steel cutters. These new machines are built in twelve sizes, in Plain and Duplex styles, ranging from 24" to 90" table travels, powered by 7½ to 30 h. p. motors, and higher if desired. You'll find complete details of these machines, their features and benefits, in specification Catalog M-1372. Write for your copy today.

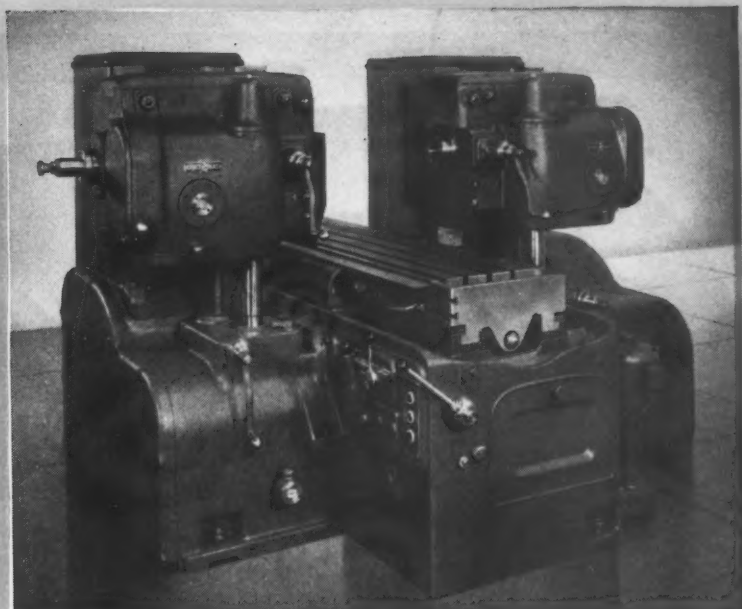


THE CINCINNATI

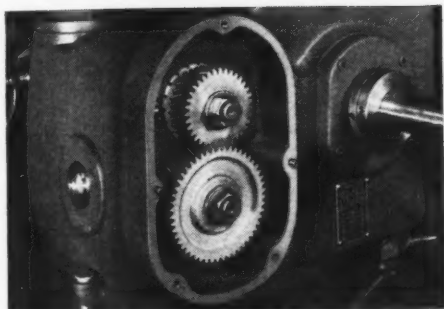
MILLING MACHINES



The new CINCINNATI No. 5-60 Plain Hydromatic Milling Machine. Catalog M-1372 contains specifications for both the Plain and Duplex styles.



The new CINCINNATI No. 4-48 Duplex Hydromatic Milling Machine. Sweet's Catalog File for Mechanical Industries gives a brief description of the Plain and Duplex machines.



These Wide-Faced Helical Pick-off Gears are indicative of the power which can be transmitted to the spindle. You have a choice of seven spindle speed ranges; pick-off gears provide eight speeds in each range.

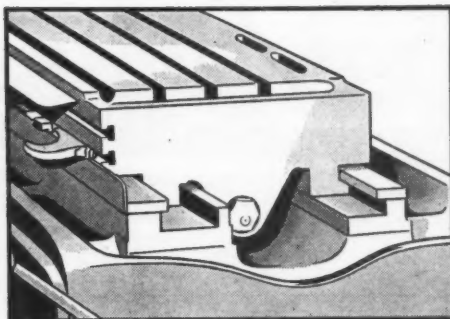
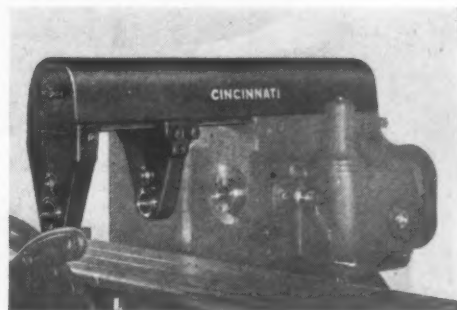


Table is exceptionally heavy. Ways have Square Gibbed Bearings. This construction adds to the smoothness of table traverse when taking high speed carbide cuts, or wide, deep cuts at a low cutting speed. Also improves accuracy.



The rectangular overarm, a well-known CINCINNATI feature, is exceptionally heavy. A built-in vibration damper gives it added effectiveness in providing a rigid, stable support at the outer end of the arbor.

● In addition to the features shown, the new CINCINNATI Hydromatic Milling Machines have: 1) Hydraulically Actuated Table Traverse with Cincinnati Locked Hydraulic Feed. 2) Automatic Table Feed Cycles, with power rapid traverse to quickly bring cutter to work. 3) Infinite Number of Table Feed Rates. 4) Automatic Change of Feed Rates. 5) Conveniently Grouped Controls at the operator's normal working position. Electrical control buttons are built in, next to the operating levers. 6) Single Four-Position Lever for com-

plete table control. 7) Coolant Automatically Starts and Stops with Spindle Rotation. 8) Spindle Drive Gears are Helical and Spiral Bevel. 9) Improved Chip Collection and Coolant Control. 10) Automatic Lubrication with Low-Level Cut-Out. 11) Built-in Leveling Jacks. 12) Spindle Speed Change Gears. Stored in Motor Compartment Cover. ¶ These and many more features are a part of the new CINCINNATI Hydromatic Milling Machines. Write for complete description and engineering specifications.

TI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U.S.A.

BROACHING MACHINES

CUTTER SHARPENING MACHINES

Introducing The Features OF THE CINCINNATI 14"-L PLAIN HYDRAULIC GRINDING MACHINE



CINCINNATI FILMATIC 14"-L Plain Hydraulic Grinding Machine. For precision grinding operations on parts within the 10' machine range, but requiring a larger swing. Built in five between-center lengths, from 18' to 96'.

● Like other machines in Cincinnati's line of five precision Plain Hydraulic Grinders, the 14"-L size, recently announced, has many features which contribute to low cost production of high quality work. Take *FILMATIC Spindle Bearings*, for example. In eliminating "flutter" and "pecking" of the diamond, quality of finish goes up. And having a much longer life than spindle bearings in any other make of centertype grinder, maintenance costs shrink to

the vanishing point. Suppose we consider another point—*Automatic Filtered Pressure Lubrication* of table ways and cross ways. This feature assures smooth traverse, and consequently better finish on the work. It also eliminates costly rescraping bills, because there's no wear in the ways. ¶ The 14"-L's have many other noteworthy features shown on the opposite page. For complete specifications, write for publication G-533.

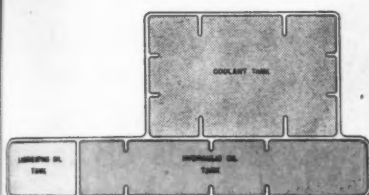


CINCINNATI

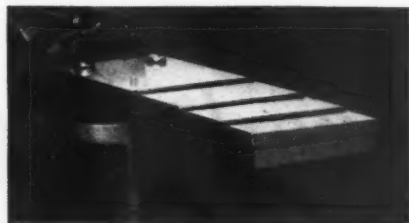
CENTER TYPE GRINDING MACHINE



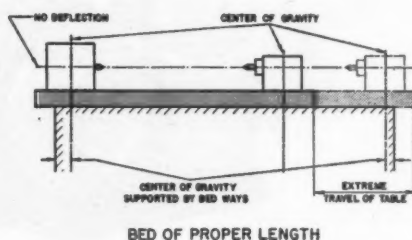
● Assembling the segments of FILMATIC Bearings. FILMATIC, an exclusive bearing in CINCINNATI Grinding Machines, produces exceptionally fine finishes and never requires maintenance. FILMATIC Bearings are self-adjusting, and they eliminate spindle flutter and are practically foolproof.



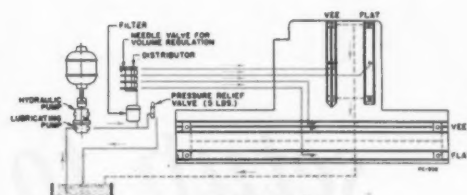
● Individual hydraulic and lubricating oil reservoirs are cast in the bed, next to the coolant reservoir. Heat remaining in the oil when it returns to the reservoirs is readily dissipated through a separating wall to the coolant. Uniform temperature means stability of alignments and closer accuracy.



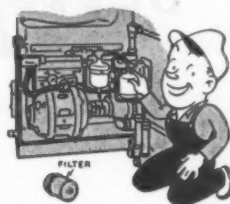
● Both ends of the table ways are protected by close-fitting telescopic guards. This feature contributes to low maintenance and long life span because it prevents dust, grit and other harmful substances from settling on the table ways. Protection of the cross ways is provided by a hinged guard at the front of the wheel head unit.



● Cincinnati Bed is a heavy casting, with correct metal distribution. With the headstock and footstock at ends of table, and table traversing its maximum stroke, center of gravity of both units is supported by bed ways. There is no deflection, and long work may be ground as accurately as short work.



● Diagram above shows system of lubricating ways. Sketch at right illustrates how easy it is to replace filters. Flow and pressure valves are also accessible here. Automatic Filtered Pressure Lubrication for table ways and cross ways adds to smoothness of traverse, helps keep down maintenance costs, and increases useful life span of the machine.



● V-belts drive the headstock from a motor mounted on top of the unit. There are no gears or chains in the headstock drive. This means an extremely smooth transmission of power, one of the factors in obtaining high finishes.

● In addition to the features enumerated above, CINCINNATI 14"-L Grinding Machines have: 1) Single Lever Start-Stop of Coolant Flow, Work Rotation and Table Traverse. This means less fatigue in operation of the machine. 2) Lever and Handwheel Retraction of Footstock Center. 3) Hand-Set Table Dogs—no wrenches are required. You'll find this reduces set-up time. 4) Exceptionally Accurate Movement of Wheel Head Cross Slide . . . your assurance of accuracy in sizing adjustments. 5) Infinitely Variable Table Traverse Speeds, 3" to 220" per minute—a sufficient range for truing the wheel and traverse grinding at any practical rate. 6) Independent Right- and Left-Hand Tarry Adjustments. These

adjustments aid finish and sizing at ends of taper work and when grinding next to shoulders. 7) Servo Hand Table Traverse (with drag adjustment for "feel")—hydraulic power does all the work of moving the table by hand. 8) Infinitely Variable Work Speeds. The right speed for every job is instantly available. 9) Accuracy of Table Reversal with power traverse engaged, within .004". This permits table traverse to be used when grinding close to shoulders. Less work spoilage. ¶ A detailed description of all the features of CINCINNATI 14"-L Plain Hydraulic Grinding Machines and their benefits to you, are contained in Catalog G-533. Write today for your copy of this publication.

ATGRINDERS INCORPORATED

CINCINNATI 9, OHIO, U.S.A.

CHINESE CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Introducing The Features OF THE CINCINNATI 14"-L PLAIN HYDRAULIC GRINDING MACHINE



CINCINNATI FILMATIC 14"-L Plain Hydraulic Grinding Machine. For precision grinding operations on parts within the 10" machine range, but requiring a larger swing. Built in five between-center lengths, from 18" to 96".

● Like other machines in Cincinnati's line of five precision Plain Hydraulic Grinders, the 14"-L size, recently announced, has many features which contribute to low cost production of high quality work. Take *FILMATIC Spindle Bearings*, for example. In eliminating "flutter" and "pecking" of the diamond, quality of finish goes up. And having a much longer life than spindle bearings in any other make of centertype grinder, maintenance costs shrink to

the vanishing point. Suppose we consider another point—*Automatic Filtered Pressure Lubrication* of table ways and cross ways. This feature assures smooth traverse, and consequently better finish on the work. It also eliminates costly rescraping bills, because there's no wear in the ways. ¶ The 14"-L's have many other noteworthy features shown on the opposite page. For complete specifications, write for publication G-533.

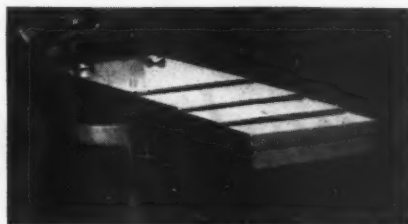


CINCINNATI

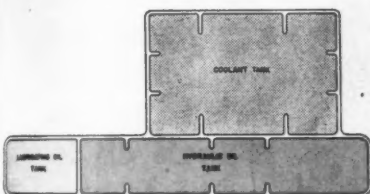
CENTER TYPE GRINDING MACHINES



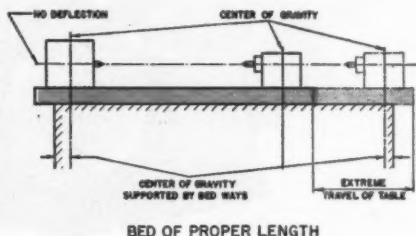
● Assembling the segments of FILMATIC bearings. FILMATIC, an exclusive bearing in CINCINNATI Grinding Machines, produces exceptionally fine finishes and never requires maintenance. FILMATIC Bearings are self-adjusting, and they eliminate spindle flutter and are practically foolproof.



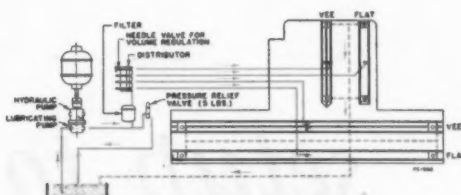
● Both ends of the table ways are protected by close-fitting telescopic guards. This feature contributes to low maintenance and long life span because it prevents dust, grit and other harmful substances from settling on the table ways. Protection of the cross ways is provided by a hinged guard at the front of the wheel head unit.



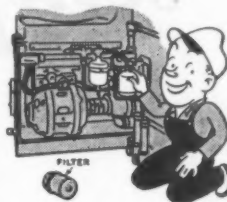
● Individual hydraulic and lubricating oil reservoirs are cast in the bed, next to the coolant reservoir. Heat remaining in the oil when it returns to the reservoirs is readily dissipated through a separating wall to the coolant. Uniform temperature means stability of alignments and closer accuracy.



● Cincinnati Bed is a heavy casting, with correct metal distribution. With the headstock and footstock at ends of table, and table traversing its maximum stroke, center of gravity of both units is supported by bed ways. There is no deflection, and long work may be ground as accurately as short work.



● Diagram above shows system of lubricating ways. Sketch at right illustrates how easy it is to replace filters. Flow and pressure valves are also accessible here. Automatic Filtered Pressure Lubrication for table ways and cross ways adds to smoothness of traverse, helps keep down maintenance costs, and increases useful life span of the machine.



● V-belts drive the headstock from a motor mounted on top of the unit. There are no gears or chains in the headstock drive. This means an extremely smooth transmission of power, one of the factors in obtaining high finishes.

● In addition to the features enumerated above, CINCINNATI 14"-L Grinding Machines have: 1) Single Lever Start-Stop of Coolant Flow, Work Rotation and Table Traverse. This means less fatigue in operation of the machine. 2) Lever and Handwheel Retraction of Footstock Center. 3) Hand-Set Table Dogs—no wrenches are required. You'll find this reduces set-up time. 4) Exceptionally Accurate Movement of Wheel Head Cross Slide . . . your assurance of accuracy in sizing adjustments. 5) Infinitely Variable Table Traverse Speeds, 3" to 220" per minute—a sufficient range for truing the wheel and traverse grinding at any practical rate. 6) Independent Right- and Left-Hand Tarry Adjustments. These

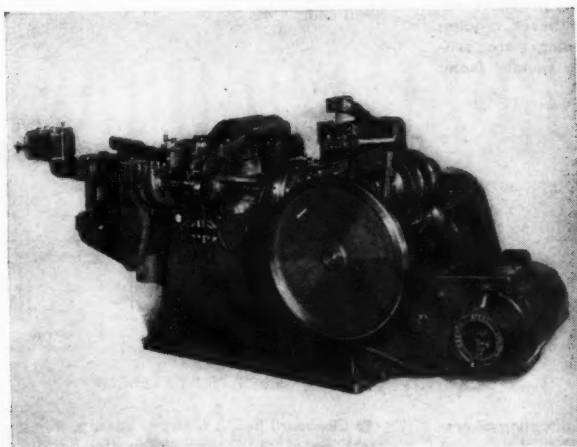
adjustments aid finish and sizing at ends of taper work and when grinding next to shoulders. 7) Servo Hand Table Traverse (with drag adjustment for "feel")—hydraulic power does all the work of moving the table by hand. 8) Infinitely Variable Work Speeds. The right speed for every job is instantly available. 9) Accuracy of Table Reversal with power traverse engaged, within .004". This permits table traverse to be used when grinding close to shoulders. Less work spoilage. ¶ A detailed description of all the features of CINCINNATI 14"-L Plain Hydraulic Grinding Machines and their benefits to you, are contained in Catalog G-533. Write today for your copy of this publication.

TIGRINDERS INCORPORATED

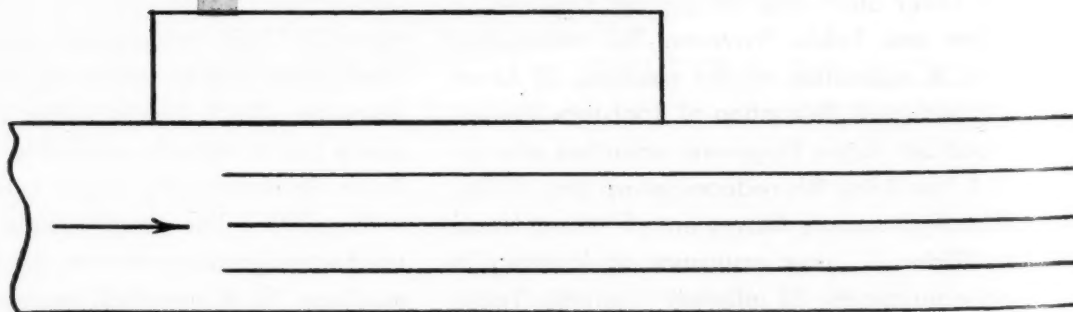
CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

The No. 33 U. S. *setup to produce with*



**THE NO. 33 U. S. MULTI SLIDE MACHINE
USED FOR PRODUCING (FOUR AT A TIME)
THE LINK ILLUSTRATED ABOVE.**



**U. S. TOOL
COMPANY, Inc.**
AMPERE (East Orange), N. J.

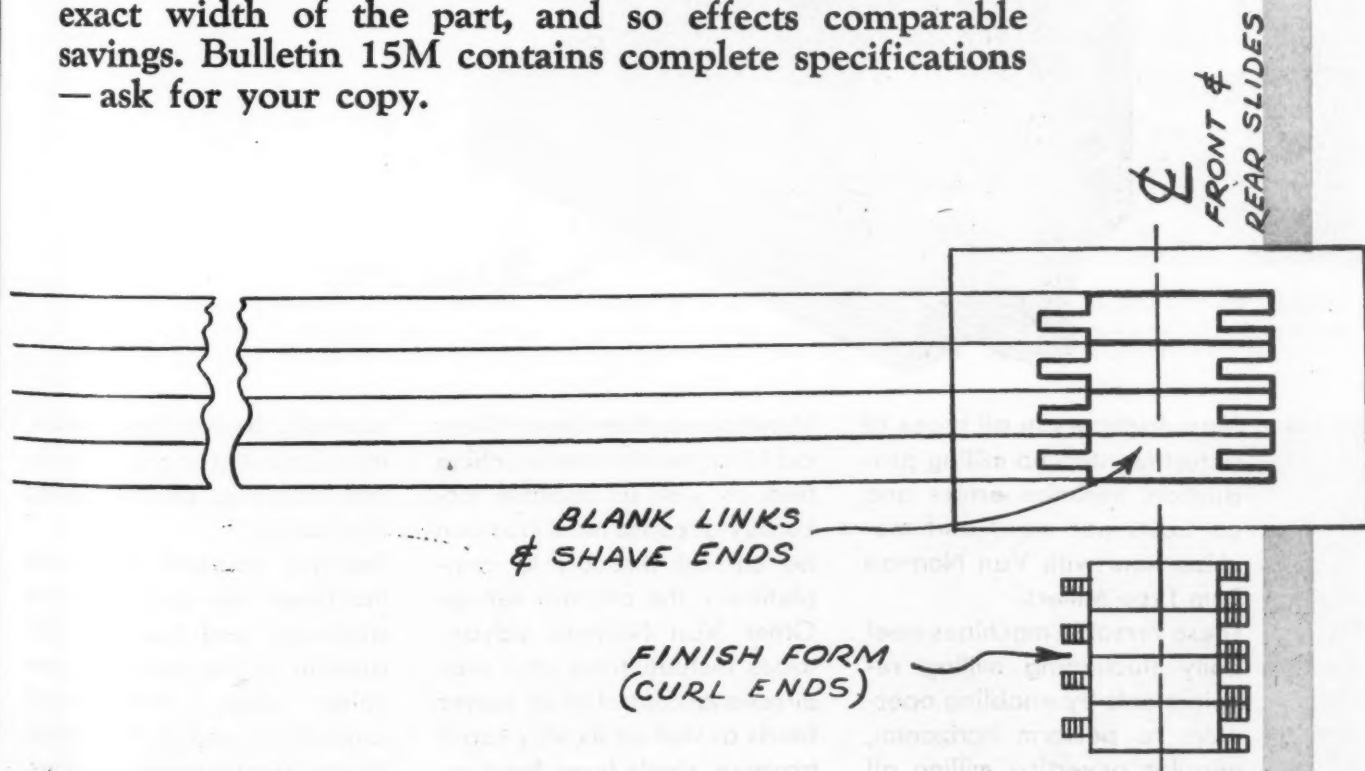
BUILDERS OF U. S. MULTI SLIDES, U. S.
MULTI MILLERS, U. S. AUTOMATIC
PRESS ROOM EQUIPMENT, U. S. DIE
SETS AND ACCESSORIES.

**MATERIAL
SHEARED
IN DIE
TO OBTAIN
FOUR STRIPS**

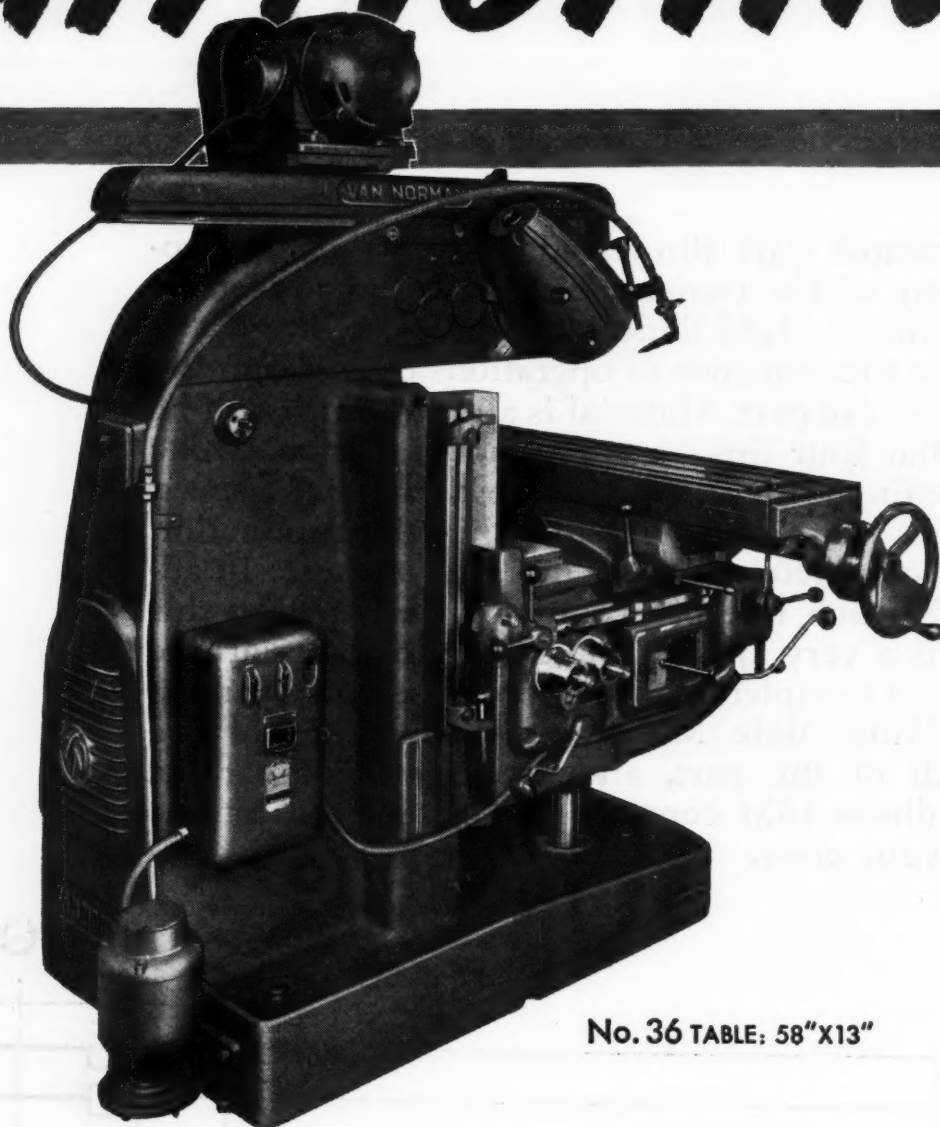
MULTI SLIDE

minimum waste of stock

The refrigerator part illustrated above is being produced at one of the General Electric Company plants using the No. 33 Multi Slide Machine. The line drawing indicates the sequence of operations followed in the fabrication of the part. Material is aluminum; it will be observed that four links are produced at each stroke of the machine which, for the work, runs at a speed of 85 strokes per minute—resulting in the production rate of 340 completely formed links per minute. In addition to the high rate of production obtained on this job, there is a very appreciable saving in material due to the almost complete elimination of scrap. On most jobs, the Multi Slide Machine uses material of the exact width of the part, and so effects comparable savings. Bulletin 15M contains complete specifications—ask for your copy.



Van Norman



No. 36 TABLE: 58"X13"

Manufacturers in all types of industries step up milling production, minimize errors and cut costs per man- and machine-hour with Van Norman Ram Type Millers.

These versatile machines meet daily fluctuating milling requirements by enabling operators to perform horizontal, angular, or vertical milling, all with one machine. In addition,

Van Norman Ram Type Millers cut idle operator and machine time as well as improve accuracy because most jobs can be carried through to completion in the original set-up. Other Van Norman advantages include front and rear *directional* control of all power feeds as well as six way rapid traverse, single lever feed selector, front and rear manual

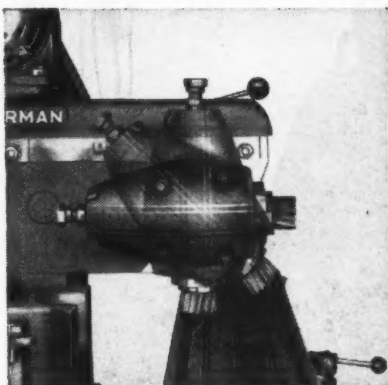
controls, heavy construction, massive cutterheads, anti-friction bearings and automatic lubrication.

See for yourself how these machines cut costs, improve accuracy and increase production in the toolroom, machine shop, experimental laboratory and pattern shop. Write: Van Norman Company, Springfield 7, Massachusetts.

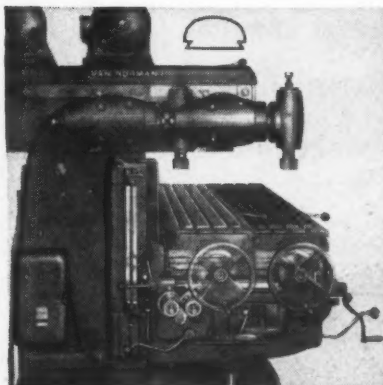
RAM TYPE MILLERS

Meet Job to Job Requirements

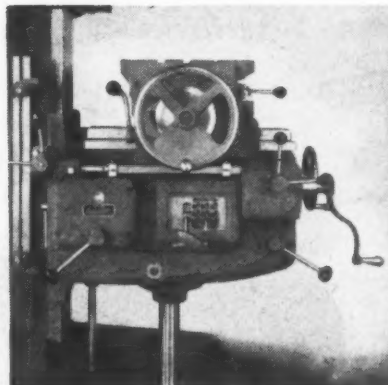
Cut Idle Machine Time Up to 50%



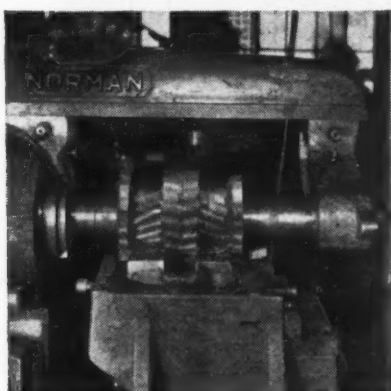
Adjustable cutterhead permits vertical, horizontal or angular milling... gives the work range of several single-purpose machines.



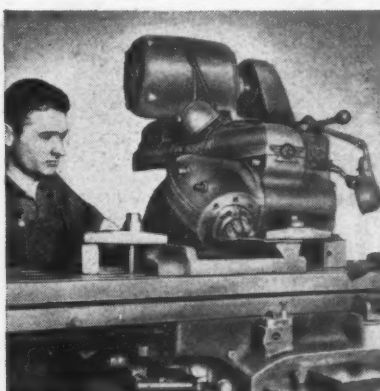
Adjustable cutterhead and movable ram in combination with the saddle crossfeed provide maximum versatility. (Subhead mounted on cutterhead.)



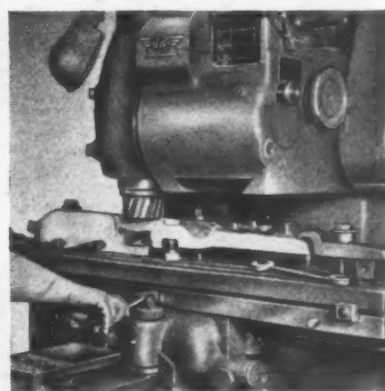
Front and rear control of hand and power feeds give complete visibility and control of operations from either location. Reduces worker fatigue.



Horizontal milling setup. The ram-type overarm with dovetail ways and outer support assures rigidity and accuracy.



With head locked in angular position the operator is taking an angular cut and operates the miller with rear controls.



The ram-type miller used with adjustable cutterhead in the vertical milling position... operator using front controls.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS



"It Pays to Van Normanize"

360 CRANKSHAFTS



Landis Tool No. 12 Centerless Grinder with separate grinding and regulating wheel bases individually adjustable.

LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY

PER HOUR

with Centerless Infeed Grinding

Infeed Grinding Work Rest Brings Centerless High Production To Shoulder Grinding

A refrigerator manufacturer had a problem of cost reduction and increased output of compressor parts. Sales inducements like five year guarantees and sealed units made it imperative that quality be maintained or improved.

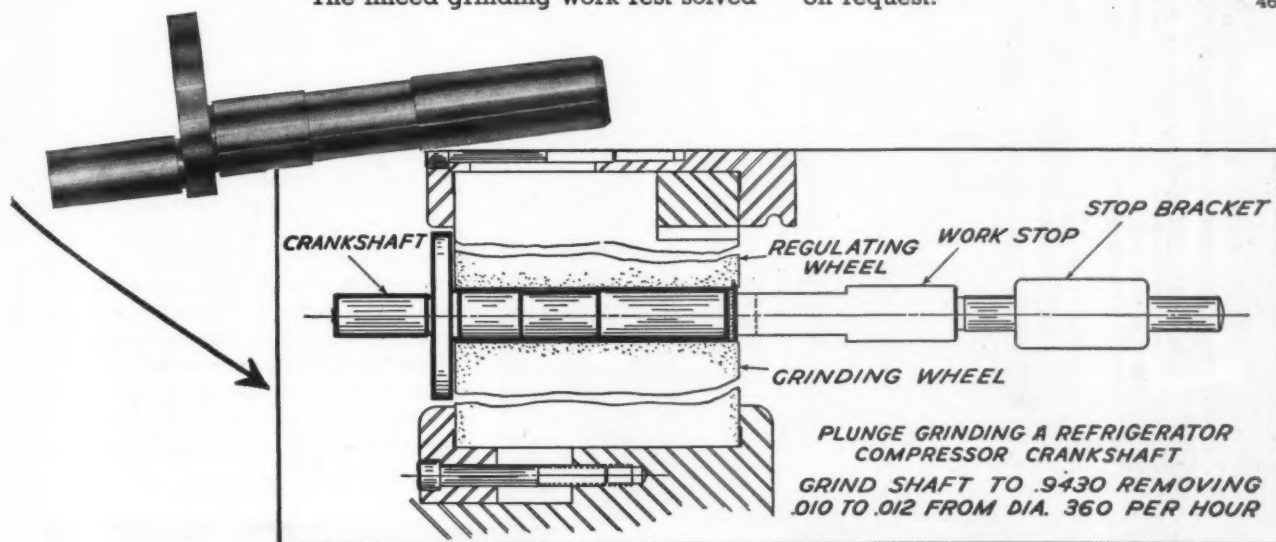
When the job was turned over to Landis Tool grinding engineers they recognized that the high production requirements and fine finish called for centerless grinding.

The infeed grinding work rest solved

the crankshaft grinding problem and with its adjustable feature made possible infeed grinding of the refrigerator compressor piston also. Production of both by infeed grinding was at the rate of 360 units per hour—a substantial production increase that lowered costs.

For help with your grinding problems, call on Landis Tool for Engineered Grinding Service. Catalog T-44 gives full information on the Centerless—available on request.

46

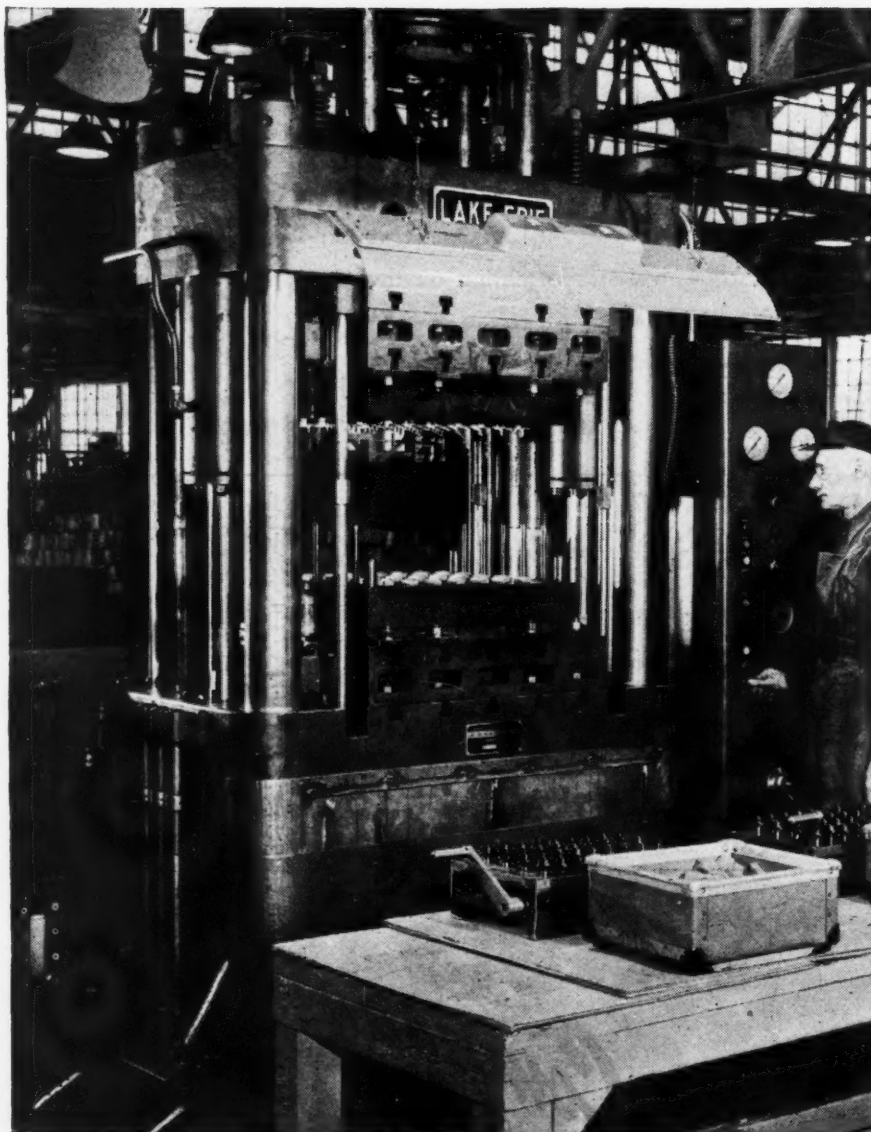
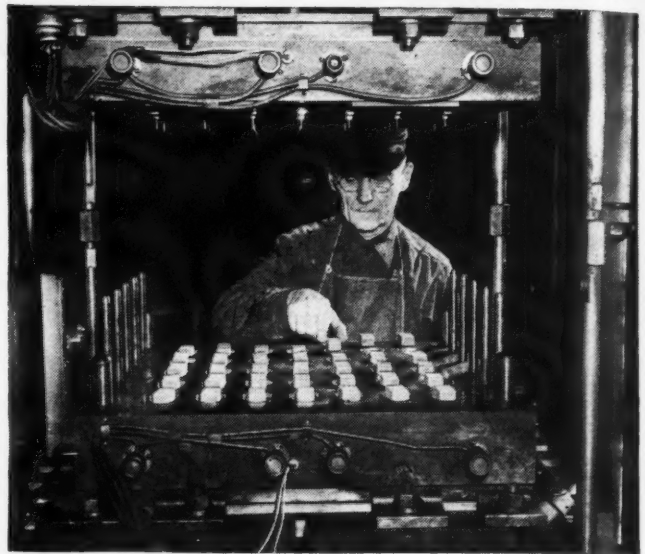


WAYNESBORO, PENNA.

LANDIS TOOL *Company*

How the Ford Motor Company

Rotors are turned out at the rate of more than 150 per hour on this 300-ton automatic Lake Erie Hydraulic Press at the Rouge Plant.



1 Preforms of thermosetting plastic material are placed in the 35-cavity mold. A rivet has already been inserted in each cavity and will become an integral part of the rotor. The preforms are seasoned for 24 hours at 110° F. in a room with strictly controlled humidity, and are preheated for 3 minutes at 180° F. in an infra red oven before being placed in the press. The wide opening between the platens of the Lake Erie press permits easy access to the entire working area of the mold.

2 A push of the button and the fully automatic molding cycle is underway. The bottom platen rises quickly to the closed position, slowing its speed as soon as contact is established with the upper platen. While the press is closed, heat and pressure complete the molding. An adjustable timer governs the time the press is closed, while the temperature of the electrically heated platens is thermostatically controlled within a four degree limit.

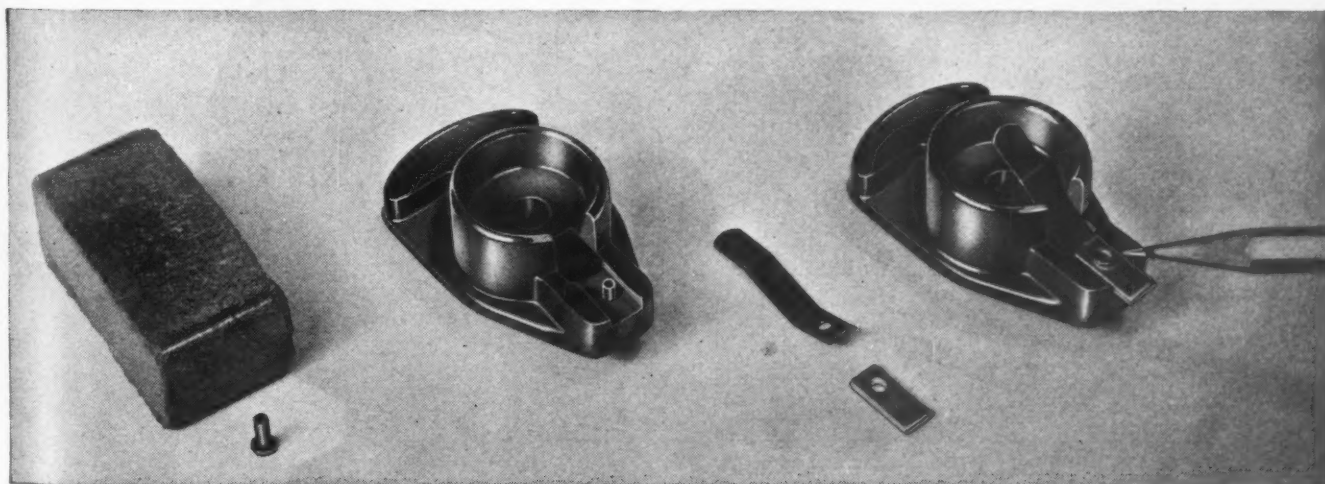
produces Distributor Rotors...



3 When the molding cycle is completed—the press is closed for 5 minutes at 300° F.—the Lake Erie Press automatically opens to its full width. The operator then removes the molded rotors and flash or excess material. Within 2 minutes after the molded rotors are removed from the Lake Erie press, they are placed in the ingenious cooling fixture shown in 4.



4 The rods on which the rotors are being mounted are exact duplicates of the rods on which the rotors will be assembled in the distributor. In cooling to room temperature, the rotors shrink onto the rods and are held to within 2/10,000 of an inch of the exact fit required for installation in the Ford engine. A turn of the crank strips the cooled rotors from the rods.



Various stages in the manufacture of Ford rotors. At the left is the preform of thermosetting plastic material and the rivet which is integrally molded in the rotor. Next is the molded rotor with steel spring and

brass tongue ready for assembly. At the right is the completed rotor. The pencil gives an idea of the small size of the parts and the need for precision presses and molds in manufacturing this vital Ford part.

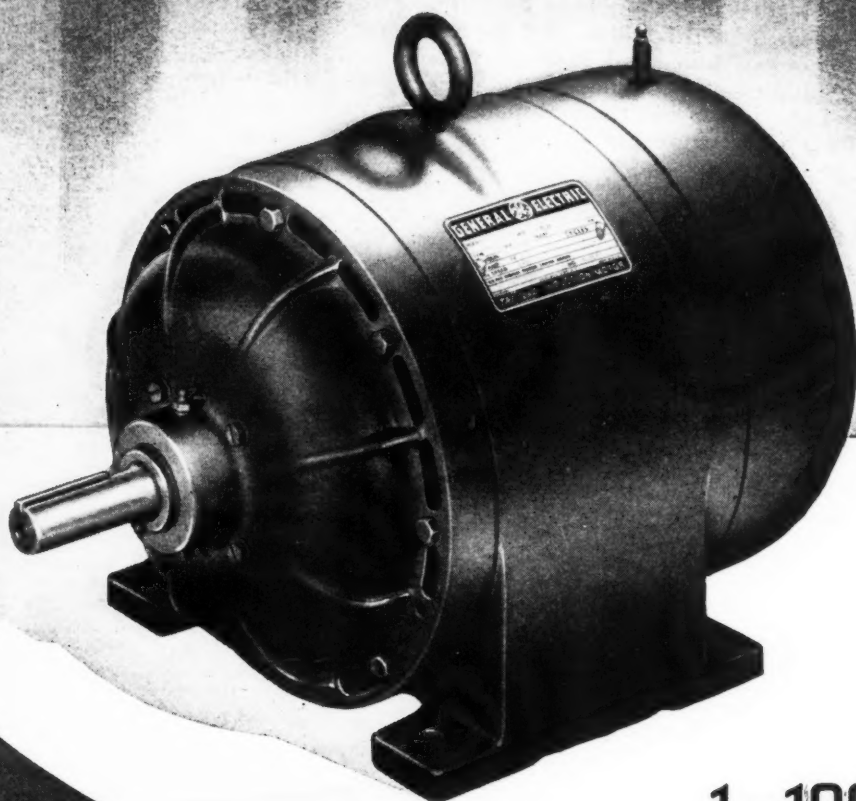
● *Lake Erie Hydraulic Molding Presses, Laboratory and Test Presses are fully illustrated and described in Bulletin 544 just off the press. Write for a copy of this latest information today.*



**LAKE ERIE
ENGINEERING CORPORATION**
170 Woodward Ave., Buffalo 17, N. Y.
Offices in Principal Cities and Foreign Countries

Leading manufacturer of hydraulic presses
...all sizes and types... plastic molding...
metal working... processing... rubber vul-
canizing... stereotyping... special purpose.

GENERAL ELECTRIC Announces



**COMPLETE ENCLOSURE
FOR PROTECTION
AGAINST DIRT, DUST,
AND WEATHER**

1 to 1000 hp

NEW

Totally Enclosed

TRI-CLAD MOTORS

In 1940, G.E. introduced the Tri-Clad open motor—with emphasis on the feature that industry wanted most in a motor, *protection*. Since then, more Tri-Clads have gone into service than any other integral-horse-power motor.

Today, we are ready with a new line of Tri-Clad motors—*totally enclosed, fan-cooled motors*—built on Tri-Clad design principles in both standard and explosion-proof types.

We believe that these are industry's most dependable motors. They are designed specifically for use in many adverse atmospheres—in iron dust, outdoors, in hazardous areas, and chemical atmospheres. Their scope of application is as wide as the field of industrial motor use. Safeguarded against most sources of motor damage, their longer life and lower maintenance will make them economical motors for use on almost every job. *General Electric Company, Schenectady 5, New York.*

GENERAL  ELECTRIC



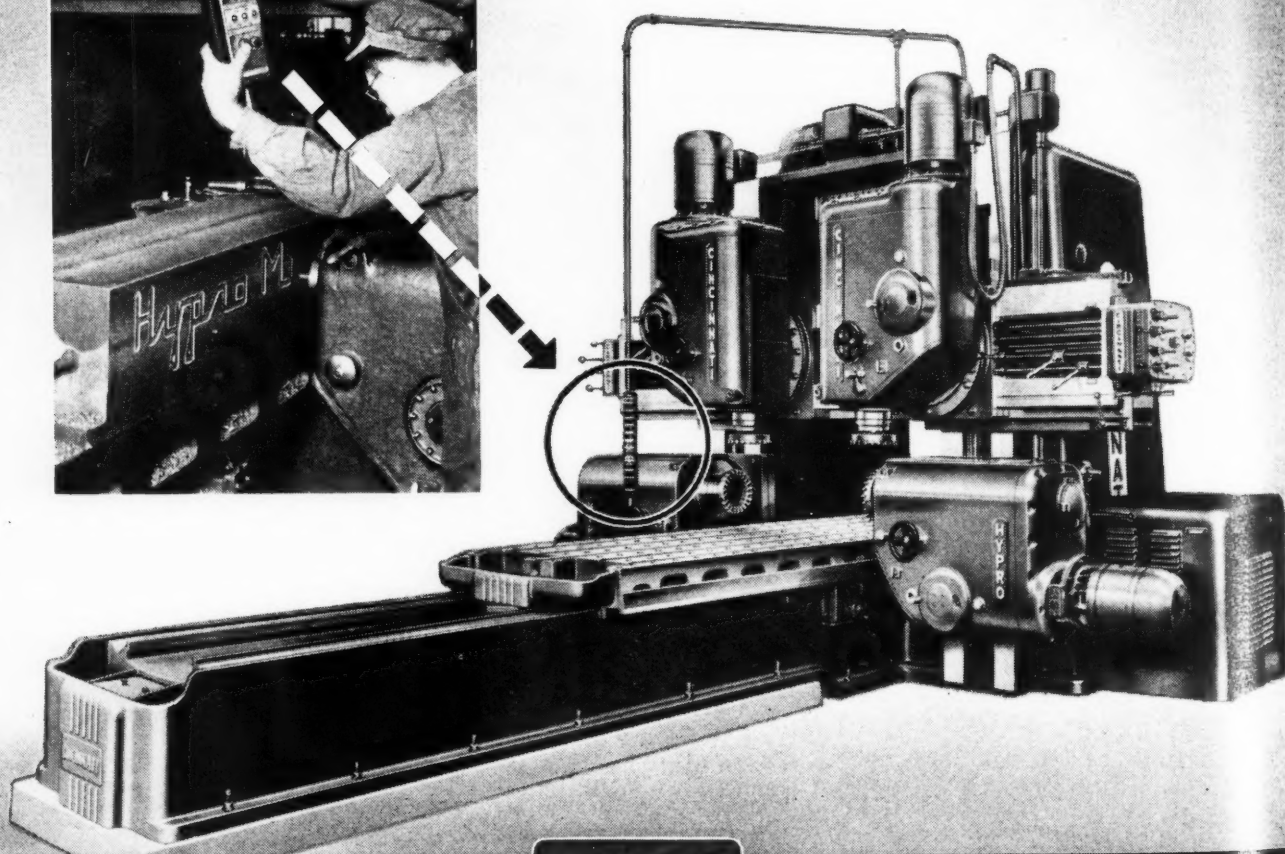
NOW COMPLETE FINGER-TIP CONTROL
FROM PENDANT STATION...

Hypro·*electronic*

PLANER MILLER DRIVE

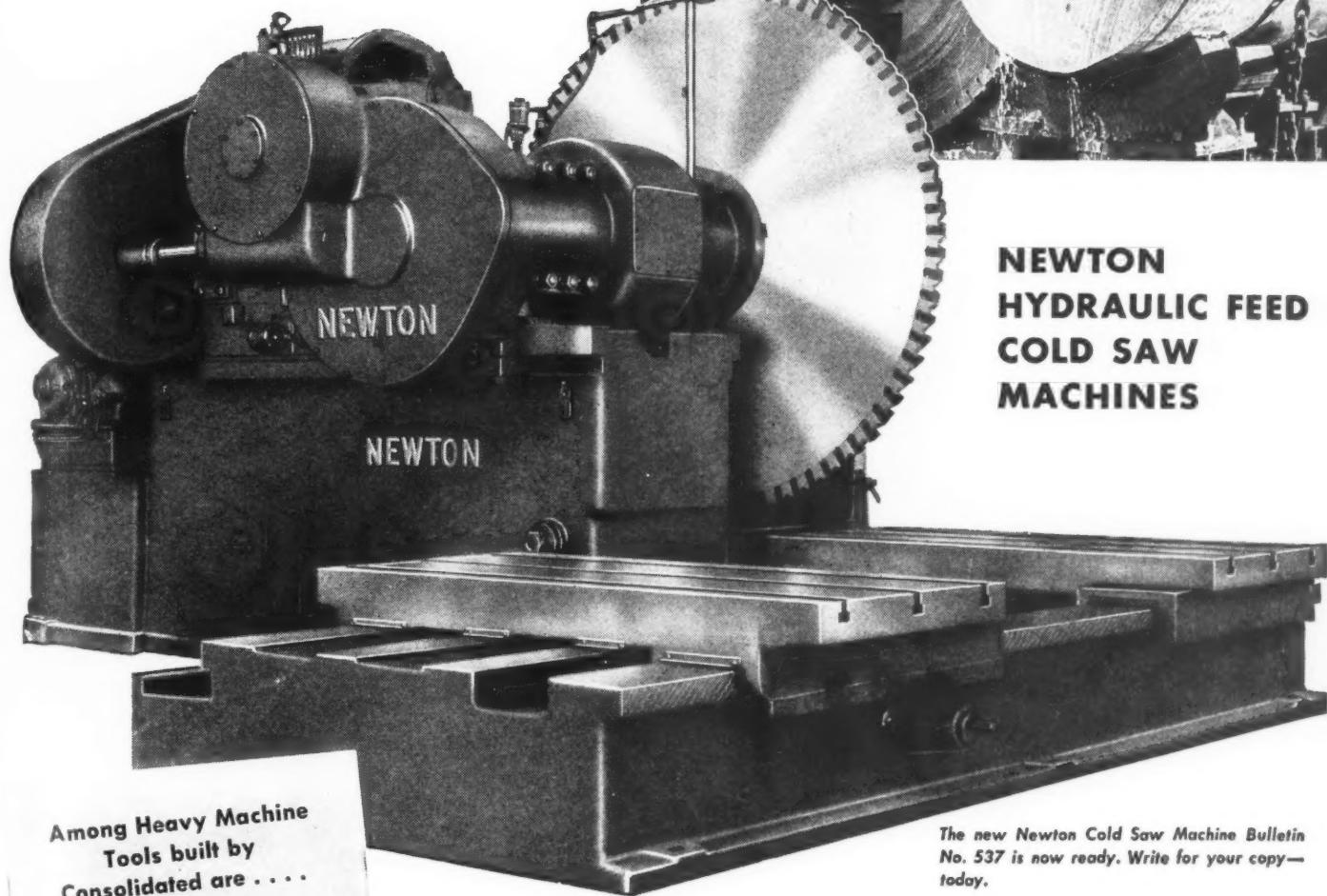


Photo on left shows operator milling the words Hypro Miller in cast-iron block — an unusual demonstration of the versatility and absolute control of any head or table from pendant station exclusively.



THE CINCINNATI HYPRO PLANER COMPANY
PLANERS - BORING MILLS - PLANER TYPE MILLERS
CINCINNATI, OHIO

**Their savings
mean lower
operating costs**



**NEWTON
HYDRAULIC FEED
COLD SAW
MACHINES**

**Among Heavy Machine
Tools built by
Consolidated are . . .**

**LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL TOOLS**

*The new Newton Cold Saw Machine Bulletin
No. 537 is now ready. Write for your copy—
today.*

**NEWTON Hydraulic Cold Saw Machines are built in a
range of designs of proved adaptability to handling all
types of work in either ferrous or non-ferrous metals.
Built in sizes to accommodate blades from 32" to 120"
diameter.**

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

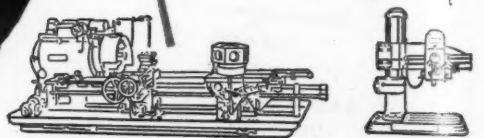
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN



**CONSOLIDATED
MACHINE TOOL CORPORATION**

ROCHESTER 10, NEW YORK

HERE'S WHAT YOU'VE BEEN WISHING FOR...



*Check
Clip
Mail*

Manager, CIMCOOL Division
Cincinnati Milling Machine Co.
Cincinnati 9, Ohio, U. S. A.

M-6

____ Please send me a copy of "What Is Cimcool?"

____ Please have sales representative call.

Name _____

Company _____

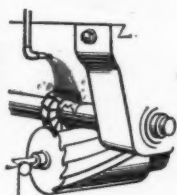
City _____ State _____

CIM

One Cutting Fluid That Covers 85% of ALL JOBS!

Yes, it's true! CIMCOOL replaces all water emulsions and all but very highly compounded specialty oils . . . actually handles 85 per cent of all metal working operations...does it at lower cost and does it better, for CIMCOOL combines high cooling capacity with high friction reduction in a degree never before attained.

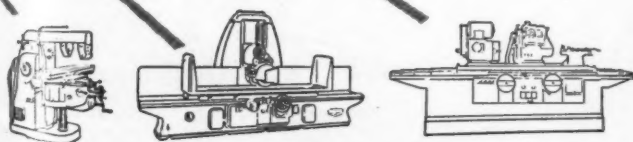
CIMCOOL was developed *and is used* by the world's largest machine tool builder. Investigate today!



A CASE IN POINT After switching to CIMCOOL on difficult milling operations, the King Machine Tool Company of Cincinnati states: "We have had an increase of about 50 per cent in tool life . . . and at the same time we have increased speeds and feeds." The company further reports that CIMCOOL has made a big hit with its operators and its use has eliminated all signs of dermatitis.

Division of
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

The Multi-Purpose Cutting Fluid



COOL

Why CIMCOOL will help YOU increase efficiency...lower costs!

CIMCOOL helps increase production rates. Increased cooling capacity permits higher cutting speeds and feeds. Grinding wheels cut more freely. Low surface tension allows small chips and grit to settle out rapidly.



CIMCOOL helps increase tool life. Chemical lubricity reduces tool wear. Tools are kept cool to touch. Increased wetting action permits greater penetration between tool and chip.



CIMCOOL reduces down-time on machines. Fewer tool changes and fewer changes of cutting fluid are necessary. Pump and supply lines are kept clean. No spoilage.



CIMCOOL facilitates accuracy. Freer cutting reduces pressure. Uniform temperature is maintained on work and on machine. Dirt does not stick to work or gages, permitting faster, more accurate gaging.



CIMCOOL is tops with operators. It restricts bacterial growth, does not contain animal or vegetable oils subject to rancidity, and is not a skin irritant. Smoke, objectionable odors and hot chips are eliminated.



CIMCOOL is safest. Fire hazards are eliminated. Absence of slippery film on operator's hands, machine controls, work and floor reduces danger of accidents. Restriction of bacterial growth limits risk of infection.



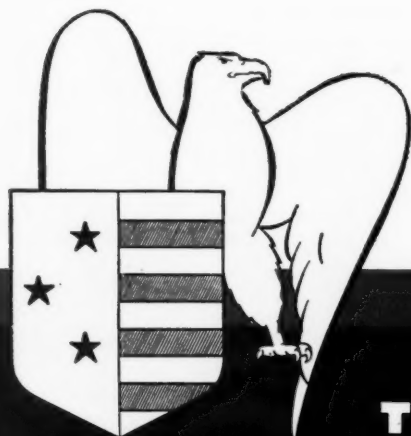
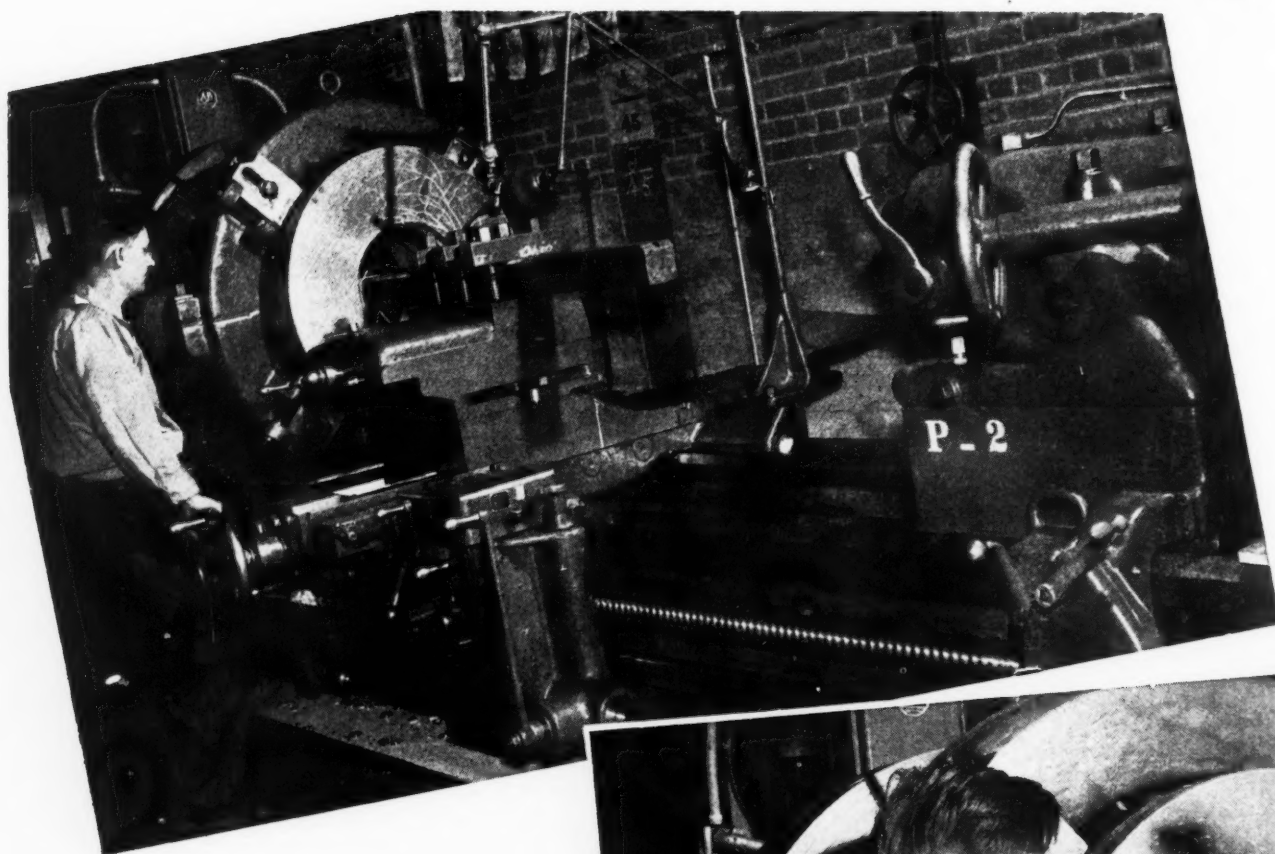
CIMCOOL contains a rust inhibitor good for the life of the fluid for protection of machine and work. It contains no chromates or highly alkaline components which may be irritating to the skin.



CIMCOOL is applicable to 85% of all metal-working operations requiring cutting fluids. It replaces all water emulsions and all but very highly compounded specialty oils for selected jobs.



Like all True A



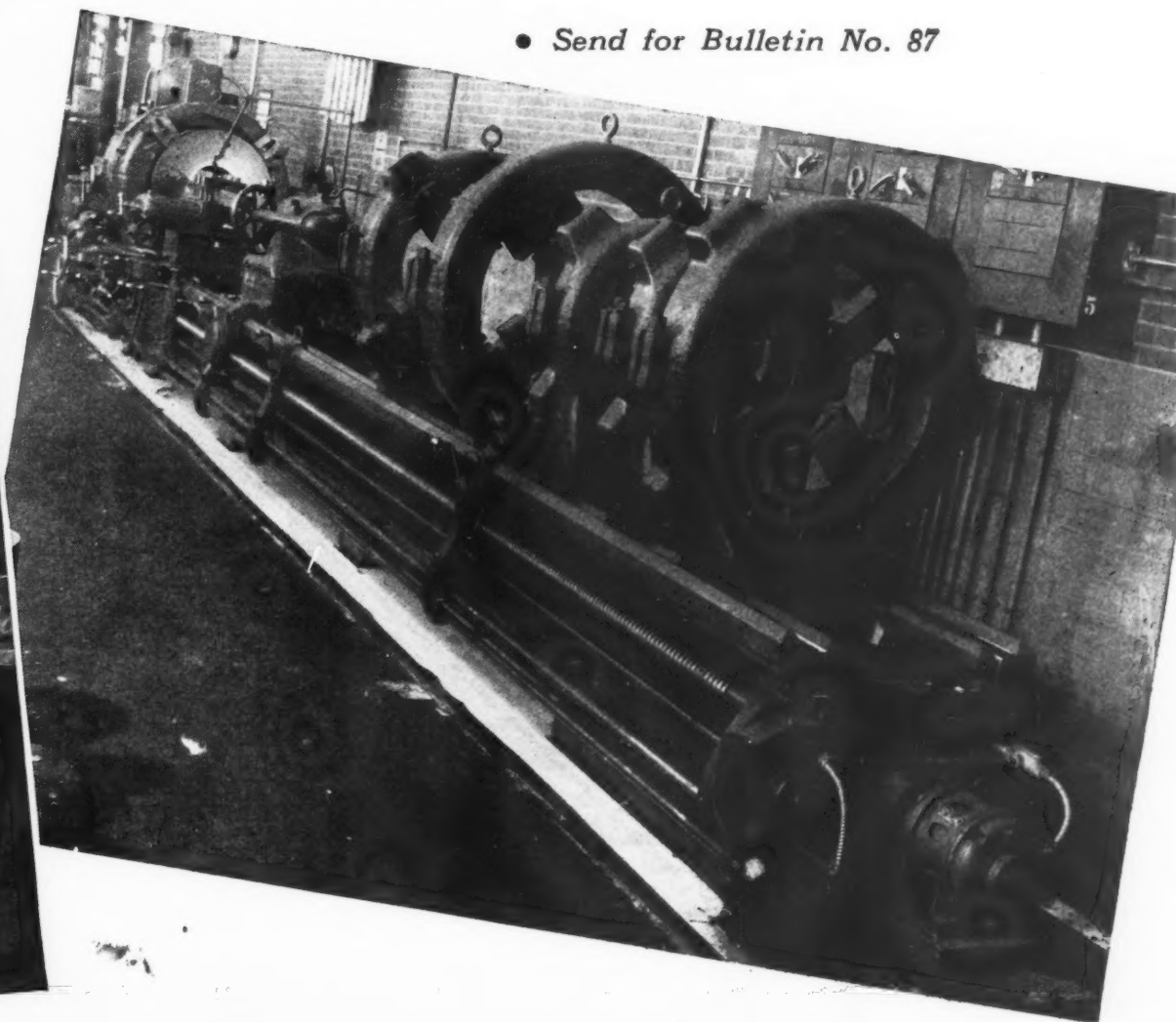
THE AMERICAN TOOL WORKS CO

e AMERICANS...

"AMERICAN" Lathes, from the smallest to the largest, are meeting the challenge of production like all true Americans. The power, stamina and endurance built into "American" Lathes have proven invaluable to many a production plant operating on an around-the-clock schedule. Dependable service, minimum shut-down for failures and repairs, coupled with an almost unbelievable ability to "keep going" under any and all conditions, are genuine "American" characteristics. "American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

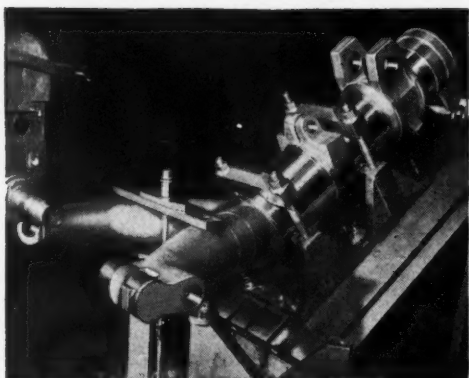
"American" Lathes are an asset in any plant.

• Send for Bulletin No. 87

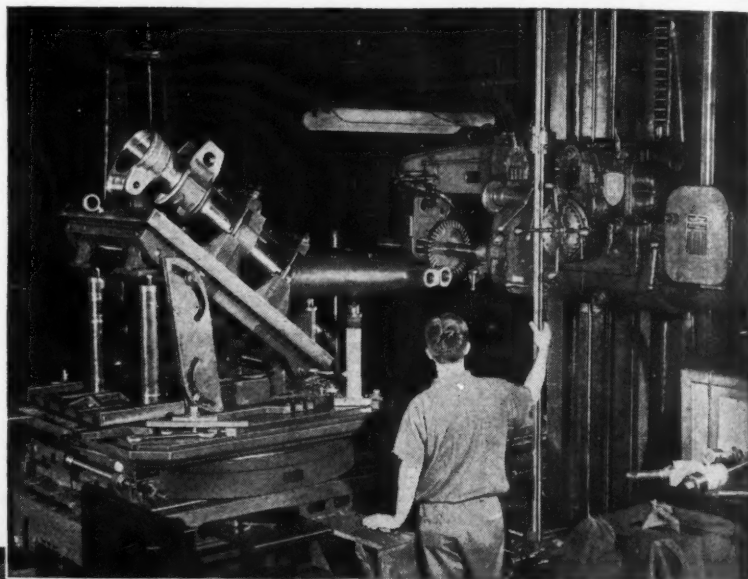


CO Lathes and Radial Drills Cincinnati, Ohio U.S.A.

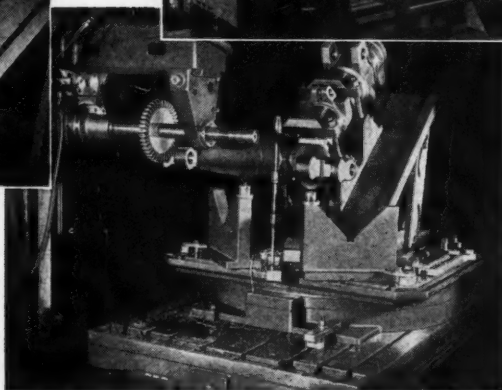
THERE'S ALWAYS A *Common Sense* **WAY**
TO EFFICIENTLY HANDLE WORK LIKE THIS
on a **G. & L.**



Aerol landing gear cylinder. Its awkward shape requires ingenuity in setting-up for precision machining operations.

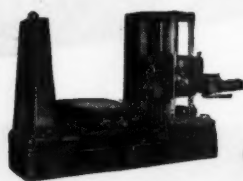


A combination of standard attachments is used on this Giddings & Lewis table type machine to simplify the setup and machining of an Aerol landing gear cylinder.

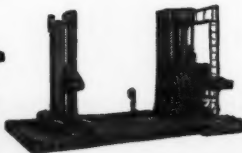


Conventional side milling operation being performed on a G. & L. horizontal boring machine equipped with an overarm type arbor support.

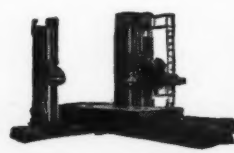
Photographs through the courtesy of the Cleveland Pneumatic Tool Company, Cleveland, Ohio



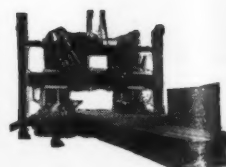
G. & L. Table Type Machine



G. & L. Floor Type Machine



G. & L. Planer Type Machine



G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.

IT IS *Common Sense* TO:

1. Use a simple holding fixture on unusual shaped parts.
2. Mill, drill and bore in a single work setting.
3. Index work on a rotary table for correct alignment.
4. Use standard machines with helpful attachments for difficult operations.
5. Use a Giddings & Lewis machine on irregular parts similar to this aircraft landing gear cylinder.

There is always a practical and common sense way to set up odd-shaped work and perform difficult machining operations on a Giddings & Lewis machine. These graphic illustrations show how an awkward-to-handle aircraft landing gear cylinder is setup and machined on a standard G. & L. equipped with stand-

ard attachments. Few other machines have the open working range, capacity and flexibility required to mount this work and then perform precision boring, drilling and milling operations. Trunnions, trunnion lugs, drag brace lugs and lock lugs are machined before the part is removed from its holding fixture.

Attachments Reduce Machining Time and Eliminate Excessive Handling

Three standard G. & L. attachments are used to cut machining time and reduce set-ups on this part. They are:

- (1) Combination plain and hand feed rotary table that indexes the work with micrometer accuracy and on which the holding fixture is mounted.
- (2) An overarm arbor support attachment is used to permit milling the slots in the trunnion lugs. The part does not have to be routed to a conventional milling machine when this attachment is used.

(3) An angular milling attachment (not shown) mills the flats on the trunnion lugs and drills and bores at right angles to the machine spindle. The work remains in its fixture for these operations. This combination of helpful attachments increases the working range and adds to the flexibility of the Giddings & Lewis horizontal boring machine.

When you are confronted with the problem of machining work of unusual size or shape, it is advantageous to consider standard G. & L. equipment for your needs. Experienced Giddings & Lewis engineers will gladly point out ways and means of reducing costs on special as well as general run work.

NEW 48-PAGE BOOK *Free*

Descriptive of G. & L. accessories and attachments written especially for men interested in increasing production. Write now for your copy—ask for Catalog M. A. 66.



140 Doty Street • Fond du Lac, Wis.

A Life Saver for this



Thousands of small contract shops were of immeasurable help in our country's wartime need . . . now these small businesses, along with big business, face reconversion problems.

The Ward Machine & Tool Co., Alden, New York, employing only seven men, was a busy little shop throughout the war. With the addition of a Warner & Swasey No. 3 Universal to the shop's engine and bench lathes, it produced miscellaneous parts and service tools for airplane manufacturers, tire companies, and mine sweeper parts for the Navy Department.

Terminations and cancellations came with devastating suddenness after V-J Day.

It was a case of getting other work quickly, or getting out of business. The Ward Company sought and obtained orders for peacetime parts—parts for farm machinery, floor surfacing machines, plastic molding machines and auto

trailers...yes, even small parts for fishing tackle.

It wasn't possible to produce these peacetime jobs profitably on the old equipment. The adaptability, speed and accuracy of the Warner & Swasey No. 3 Universal proved to be a veritable business life saver. It could handle the diversified new work, permit economical prices to customers and show profits.

This small shop gives full credit to this single turret lathe for enabling it to weather a serious reconversion upset.

The Ward Company, typifying the ingenuity and enterprise of small business in America, expects to *stay* in business and "go places."

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

small machine shop



**WARNER
&
SWASEY**
Machine Tools
Cleveland

NES

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY



BRYANT SERIES 112

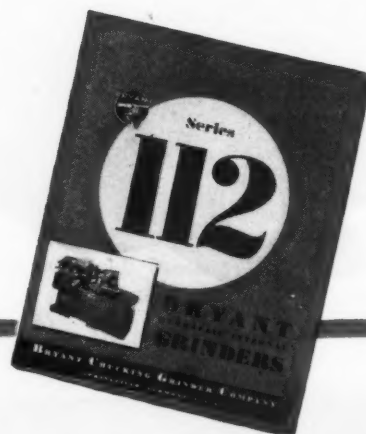
CAM LOCK FOR INTERNAL GRINDING

● MINIMIZES SETUP TIME ON TOOL ROOM WORK

Holding fixture changes in less than 2 minutes? . . . You can on the Bryant Series 112 Hydraulic Internal Grinder. This modern tool room grinder is equipped with an American Standard Spindle Nose with the quick-change cam lock feature. This means that (a) Accurate centering is provided by the tapered pilot on the spindle nose fitting into a tapered recess in the back of the chuck, (b) Squareness of mounting is obtained by the ground face in the back of the chuck registering against the ground face of the spindle nose, (c) The chuck is held rigidly in position by the locking cams in the spindle nose which engage the cam locking studs in the back of the chuck, and (d) The cam lock feature also provides a quick means of mounting and unmounting the chuck. A clockwise, one-quarter turn of the wrench on each locking cam is sufficient to lock the chuck securely.

You will find important tool room features like this at every point of the Bryant Series 112 machines. It all adds up to less down time, more accurate work, finer work finish and fast production.

For complete details — Send for the Man from Bryant.



Write for big new catalog which describes this machine in detail ➔

BRYANT



BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Can this versatile cutting fluid solve a problem for you?

Do you have some machining operations that don't seem to fit any cutting fluid you try? When cutting oils are used, tools and work overheat. When water emulsions or soluble oils are used, tool life and finish are poor. Stanicool HD Soluble Oil has taken over many jobs like this and has saved tools, parts, and machining time.

It has other qualities, too, that make it easy to work with:

- It's easy to mix.
- Does not gum up machines and work.
- Is non-irritating to operators' hands.
- Is stabilized against odor development.
- Has anti-rust qualities.

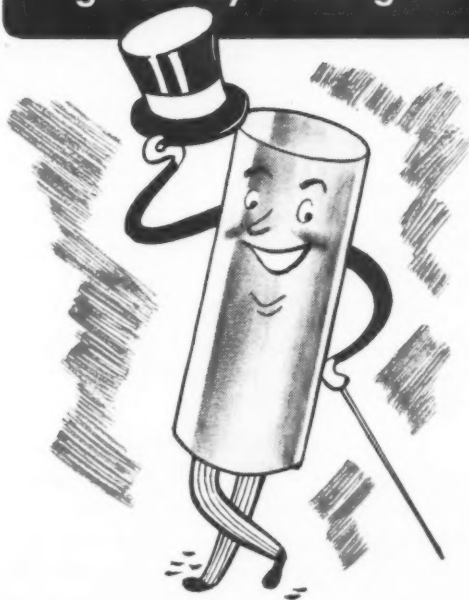
A Standard Cutting Oil Specialist will analyze any metal cutting operation that is troubling you and will recommend the cutting fluid you need. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois

STANICOOL HD

... has the cooling ability
of a water emulsion



... gives finish and tool
life approaching that
given by cutting oil



STANDARD OIL COMPANY (INDIANA)

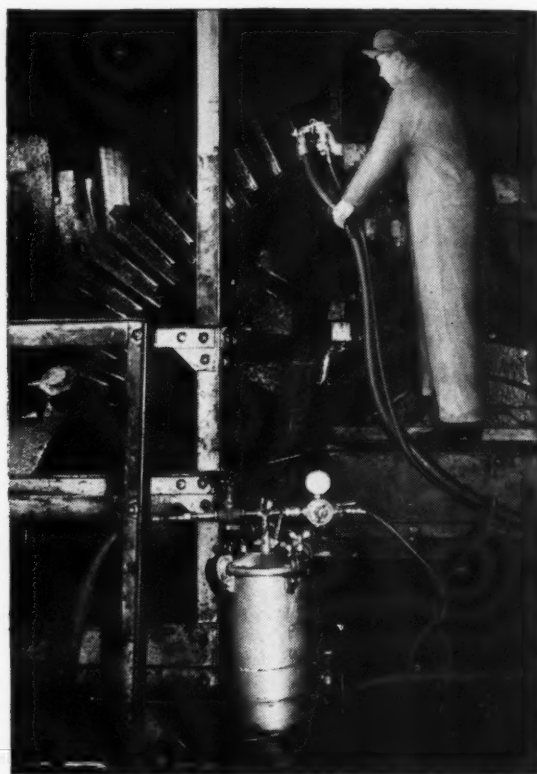
**STANDARD
SERVICE**

An improved gear lubricant that can be sprayed on gears...

CALUMET Viscous Lubricant

Calumet Viscous Lubricant is not the old type of gear shield usually made from residual products of petroleum. It is a true grease, manufactured from selected soaps and oils plus additives to secure the qualities most needed in a gear shield. In addition, a range of grades is provided, to meet all plant conditions under which gears operate.

That is why Calumet Viscous Lubricant gives the advantages listed above. Because all grades can be applied without heating, and all except the heaviest grade can be sprayed, it cuts application time to the minimum. Spraying also gives a smooth, even coating of lubricant, eliminating



One method of spraying gears is pictured above. Grease under pressure in the tank is carried to the spray gun in the large hose. A separate air hose to the gun provides pressure to break up the grease into a fine spray.

Saves time in application

Gives smooth, even film

Reduces frequency of application

Reduces throw-off

bare spots or excessive deposits which may drop off before the lubricant is worked into the gears.

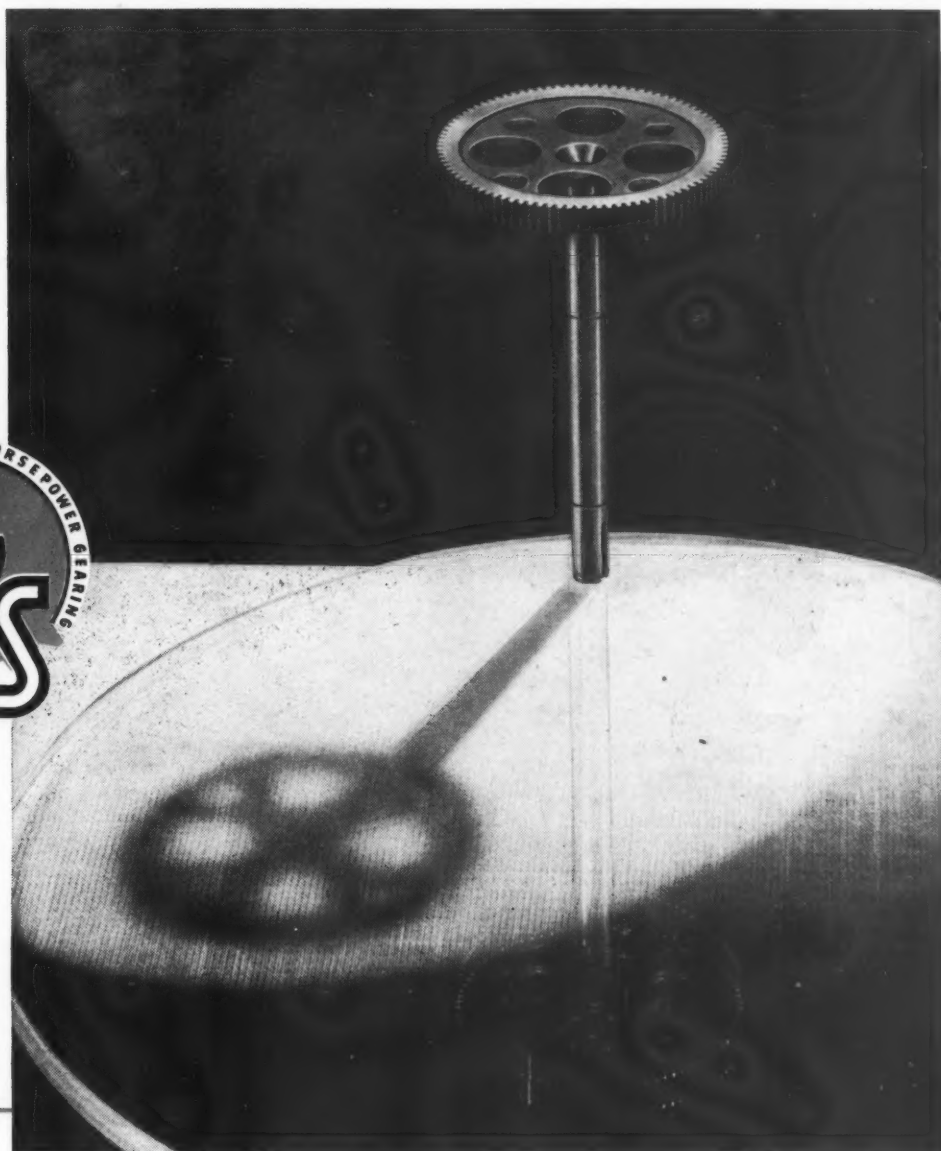
An additive in the lubricant gives it improved wetting ability—that's the ability to adhere closely to the metal—so as to give better resistance to water and heat.

Let this wear-reducing lubricant protect your plant gears. A Standard Oil Lubrication Engineer will survey your plant and help you determine the grades you need and the most economical methods of application.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**



*Precision is Measured
by Finest Fractions*



● Every gage or measuring device known to the science of small gear production is employed in the manufacture and inspection of G.S. small gears. In fact, so precise are the manufacturing standards established in our plant, that rejections have been reduced to the vanishing point. Devices and equipment in which G.S. Fractional Horsepower Gears are used function more smoothly, quietly and dependably. If the quantity production of *better, more uniform* custom-made small gears is a matter of interest to you, won't you share your problems with a highly trained specialist in this field . . . a G.S. engineer?

GEAR Specialties

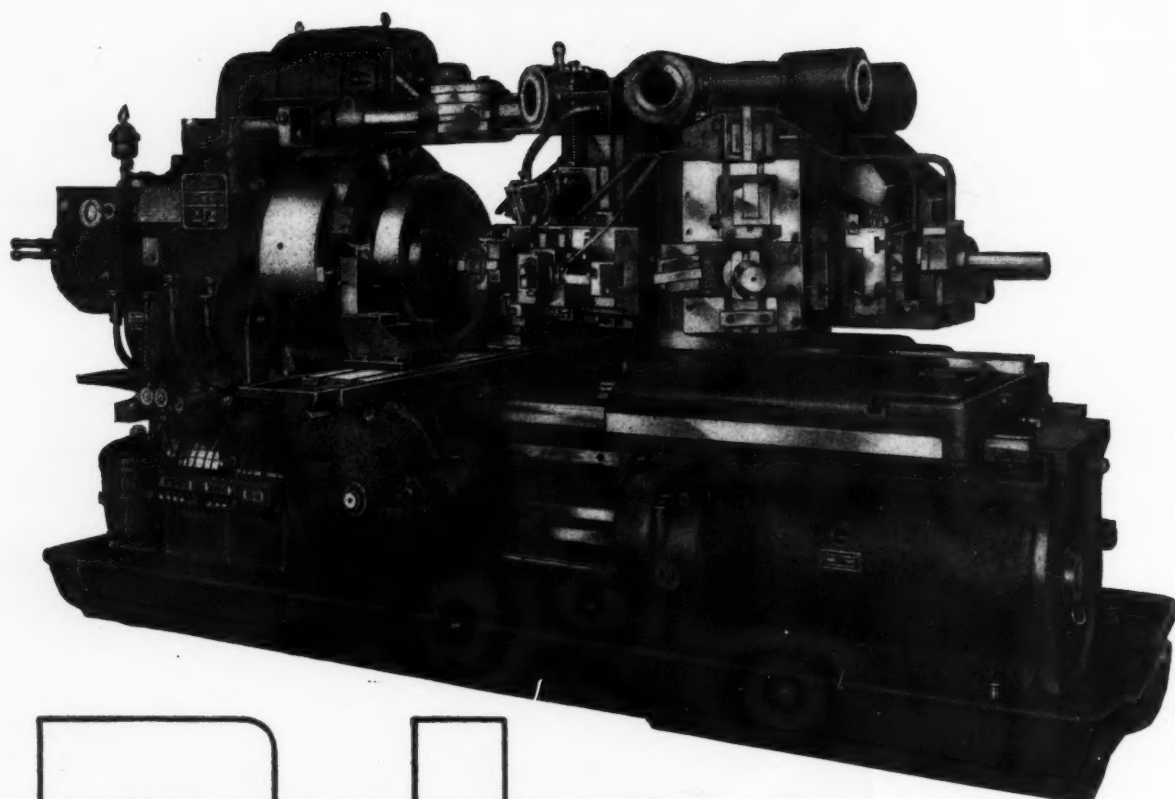
Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding
2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

IF YOU NEED

CHECK THESE PRODUCTION *FACTS*

HIGH CAPACITY



The 8-DT and 8-DXT Automatic Chucking and Turning Machines have been designed to incorporate the advantages of high production and low labor costs into a machine of greater than ordinary capacity. Power, extreme rigidity, four automatic changes of spindle speed, three selective automatic changes of feed, automatic indexing of the turret following index, direct cross slide action, electro-pneumatic clutch operation and a constant, motor-driven high speed motion of cross slide and turret slide are features which contribute to maximum production. And, because one operator usually handles a complete battery of machines, greater labor savings are realized.



BULLETIN 112

A digest of the important production facts concerning 8DT and 8DXT Automatics is given at the right. A study of these facts will indicate that the 8DT or the 8DXT machine can be used profitably in your large-part production. Send for further details and complete specifications as found in Bulletin 112.

POTTER & JOHNSTON

IN CHUCKING AND TURNING,

ABOUT P&J 8DT and 8DXT AUTOMATICS

BASE UNIT

Ways are solid blocks of hardened and ground steel, clamped in position by means of alloy steel bolts and then ground in place. Base itself is of heavy box section construction.

HEADSTOCK

All headstock gearing is of special alloy steel with spiral formed teeth. All shafts are mounted on anti-friction bearings. Spindle is made of high carbon steel forging, mounted on oversize precision ball bearings.

SPEEDS

20 Changes of speed between 7 and 160 R.P.M. are arranged in five sets of four automatic changes. Any group may be readily obtained through pick-off gears.

CROSS SLIDE

New design, with tandem cam drums directly under slide. Ball bearing cam roll studs are mounted in cross slide, furnishing a direct connection. Cam drums easily accessible for special cams.

TURRET SLIDE

Rigidly constructed and provided with hardened and ground steel inserts to form its bearing on the ways. Turret is automatically clamped after indexing. Six turret faces are standard. Four or five faces are available when specified.

FEEDS

Feed gearing is driven from the spindle, causing the feed to vary directly with spindle speed. 24 feeds are arranged in geometric progression from .003" to .119" or from .003" to .0355" per spindle revolution, as specified. A feed from each of three groups may be selected for automatic feed changes. SPEED AND FEED CHANGES—Operated automatically through dogs or by hand control. Solenoid-controlled valves time the flow of air which actuates the cylinders which, in turn, control the automatic operation of the clutches.

SPECIFICATIONS:

	8DT (up to and including serial 80607)	8DXT (starting serial 80608)
Turret Travel.....	32"	32"
Turret Dwell.....	13"	13"
Turret Feed.....	16"	16"
Travel of Turret to Start of Index.....	31½"	31½"
Turret Slide Adjustment.....	10"	20"
Cross Slide Adjustment.....	10"	25"
Swing over Bed Ways.....	36" Dia.	36" Dia.
Max. Cross Slide Travel and Feed Each Way.....	6¼"	6¼"
Swing over Cross Slide.....	23" Dia.	23" Dia.

(other combinations of cross slide travel and feed are obtainable with special cams.)

MACHINE CO., PAWTUCKET, RHODE ISLAND

BIG CHIP—FAST CUT...



WHEN MAKING A DEEP CUT on a heavy duty lathe, the machine first must be geared, powered and designed to take this rugged job in its stride... Lumbermen have a saying, "the bigger the chip, the quicker the cut."... In a close-up photograph, above, an *Axelson Heavy Duty Lathe* is demonstrating the same principle... The operator has the complete assurance that experience develops on this great lathe... From heaviest roughing cut to the finest precision metal turning, the *Axelson Lathe*

Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32-inch sizes.

turns in also an unvarying record of satisfaction, from manager and machinist alike... For the *Axelson Lathe* is a quality machine, of finest materials and workmanship... It has taken over thirty years of unflagging enterprise to produce this machine tool, to meet every demand in metal turning.

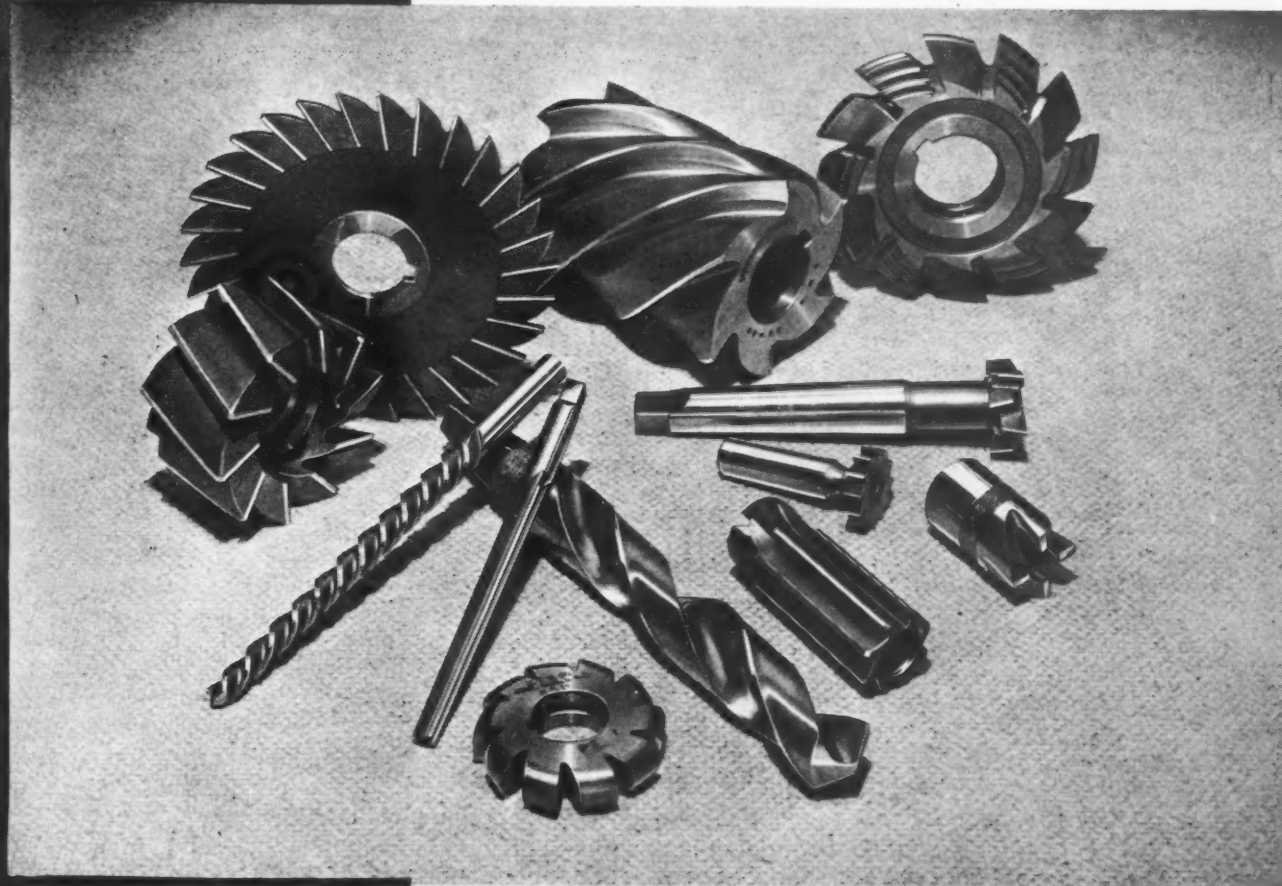
AXELSON MANUFACTURING COMPANY
6160 S. Boyle Ave. (Box 98, Vernon Station), Los Angeles 11, Calif.
50 Church St., New York City 7 • 3844 Walsh Street, St. Louis, Mo.

AXELSON LATHES

THERE IS NO
ECONOMICAL
SUBSTITUTE
FOR QUALITY

Dependable for over
a Quarter Century

Picture of Perfection



by

UNION

They're able and accurate!... They're designed for precision and proved under production pressure!... They're pictures of perfection!... They're UNION — The Tools You Buy Again!

Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec
S. W. Card Mfg. Co. Div., Mansfield, Mass.


UNION TWIST
DRILL COMPANY
ATHOL, MASS.

UNION ★ BUTTERFIELD ★ CARD Divisions of the Union Twist Drill Co.

STORES:

New York: 61 Reade St. San Francisco: 121 Second St.
Chicago: 11 So. Clinton St. Los Angeles: 524 E. Fourth St.
Detroit: 5527 Woodward Ave. Seattle: 568 First Ave., South

MACHINERY, June, 1946—39



... of course they're
BUTTERFIELDS!

They're made of the finest carbon steel and high speed steels — available in a most complete range of types and sizes to satisfy every kind of rooming operation — they're accurate, long-lived, thoroughly dependable. Of course they're BUTTERFIELDS!

BUTTERFIELD DIVISION *Derby Line, Vt.
Rock Island, Que.*

UNION ★ BUTTERFIELD ★ CARD



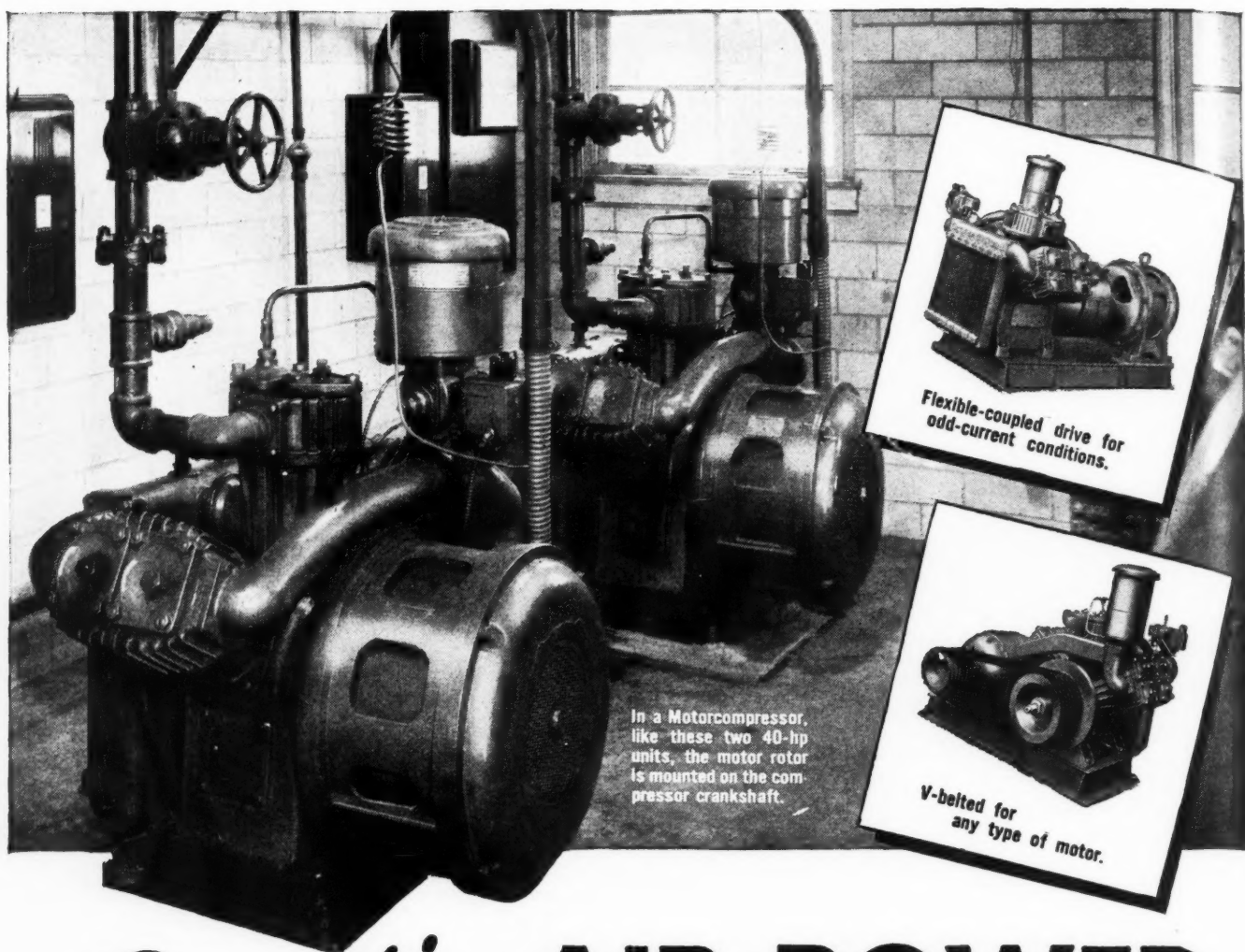
Machine Screw
TAPS by CARD

Furnished in 2 flute, 3 flute, 4 flute and
 spiral pointed styles — carbon, high
 speed cut and ground thread. Typical
 of all Card products, these Machine
 Screw Taps provide the stamina and
 efficiency for Superiority in perform-
 ance, for first-quality workmanship.

S. W. CARD MFG. CO.
Mansfield, Mass.

STOCKS
 New York: 12 St. Marks Pl.
 Chicago: 11 E. Center St.
 Detroit: 327 Woodward Ave.
 San Francisco: 121 Second St.
 Los Angeles: 224 S. Fourth St.
 Washington: 101 First Ave. N.W.

Divisions of the Union Twist Drill Company



In a Motorcompressor, like these two 40-hp units, the motor rotor is mounted on the compressor crankshaft.

Flexible-coupled drive for odd-current conditions.

V-belted for any type of motor.

Generating AIR POWER WITH AIR-COOLED COMPRESSORS

TYPE 40 MOTORCOMPRESSORS

7 Sizes from 15 to 90 hp
Two-Stage Compression
Completely Air-Cooled
Efficient Channel Valves
Compact and Light Weight
No Special Foundation Needed
Timken Roller Main Bearings
Constant-Level Lubrication
Dual Control for Efficient Regulation under any kind of load.
Built-in Motor, V-Belt, or Flexible-Coupled Drive.

For sizes $\frac{1}{2}$ to 15 hp, use Ingersoll-Rand Type 30, Air-Cooled Compressors

By using Two-Stage Air-Cooled *Motorcompressors* to generate your Air Power, you eliminate the cost of water, water piping, and the danger of freezing.

These compact, light-weight, and well-balanced compressors require practically no foundation. They are installed, and serviced, easily and quickly.

Where such factors are primary considerations, *Motorcompressors* are ideal for the main air supply...or for supplementing the capacity of your larger compressors during peak loads...or for locations remote from the main compressed-air and water lines. And their efficient two-stage design will save power.

To increase the output of your plant, or to cut over-all production costs, you may need *more* Air-Power. An Ingersoll-Rand engineer can help you select air equipment best suited to *your own requirements*...compressors that generate *lowest-cost* Air Power, and the tools that get the most work out of the Air.

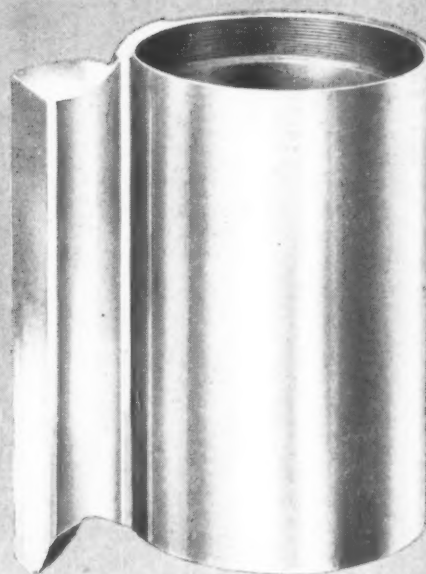
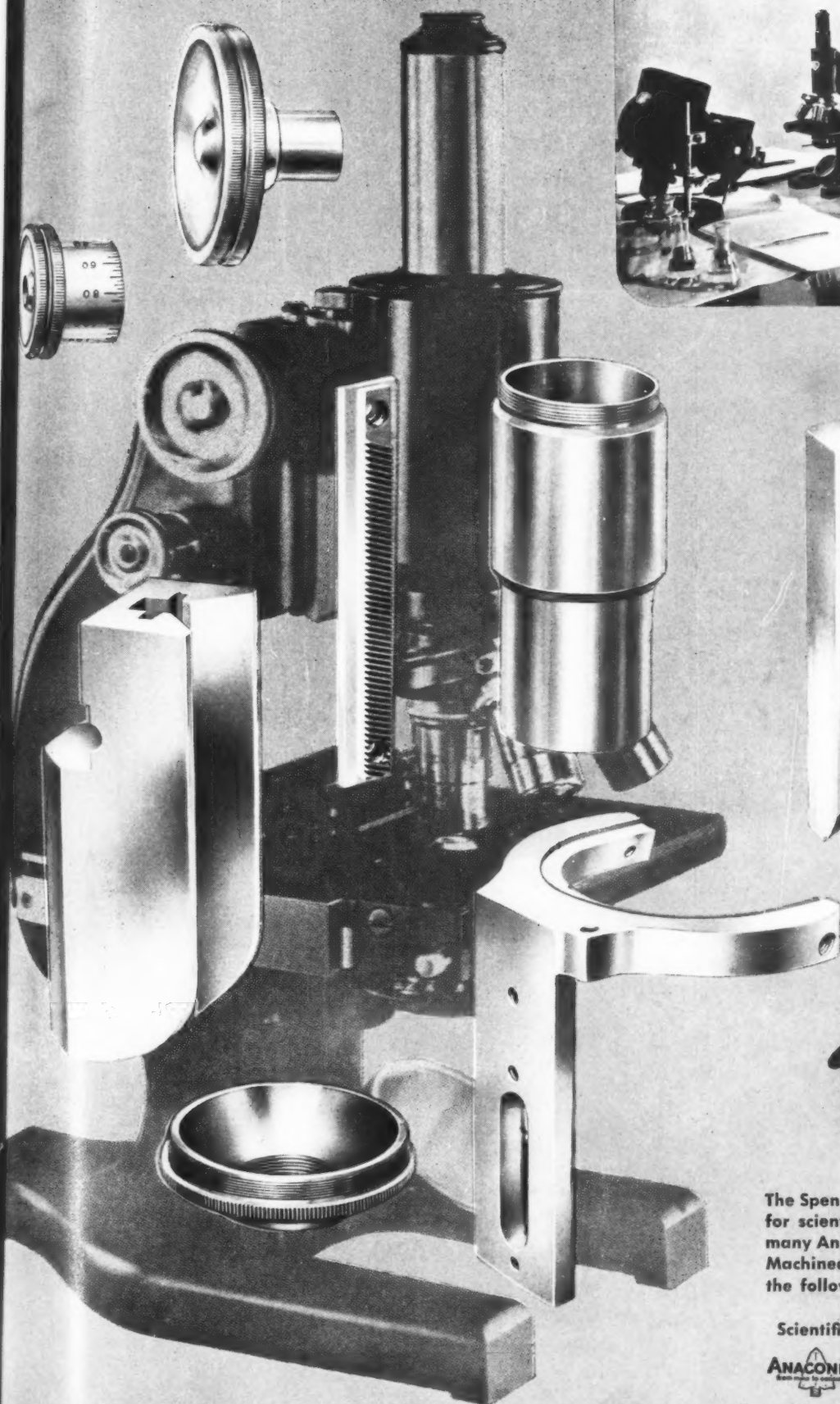
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

1-771

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

Where **PRECISION** is the goal
BRASS is the metal...



Why? →

The Spencer Microscope, used throughout the world for scientific and medical work, and some of the many Anaconda Brass parts used in its construction. Machined samples, illustrated and described on the following page, were supplied by courtesy of American Optical Company, Scientific Instrument Division, Buffalo, New York.



THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut

Here's why

Nothing serves like *BRASS*

IN THE CONSTRUCTION OF SCIENTIFIC INSTRUMENTS

MODERN MICROSCOPES, and similar optical instruments, have one important attribute in common—accuracy in the lens system . . . often held to a *millionth of an inch!* And for the necessary rigidity of the instrument, positive operation, smoothness and precision of adjustment—nothing short of mechanical perfection will do.

That is why, for the critical mechanical parts illustrated below and on the preceding page, nothing serves as well as Brass. For Brass is a sturdy metal . . . it is strong, tough, durable, corrosion resistant, and does not rust. It machines readily—leaves clean, full-formed threads and knurls . . . provides exceptionally smooth milled, reamed or turned surfaces for bearing or mating parts.

Brass is economical, too. Through The American Brass Company it is produced in a wide range of readily-adaptable alloys in commercial forms; also in special extruded and drawn shapes, hot pressed parts and pressure die castings. We'll be glad to cooperate in determining the form and alloy most suitable for your needs.



THE AMERICAN BRASS COMPANY

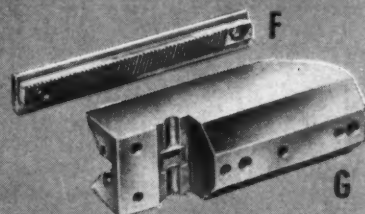
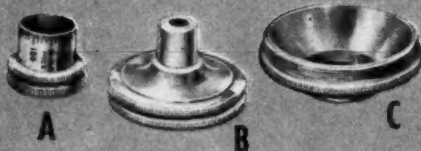
Subsidiary of Anaconda Copper Mining Company

General Offices: Waterbury 88, Connecticut

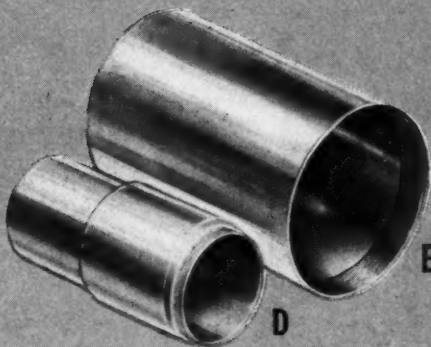
In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

46154

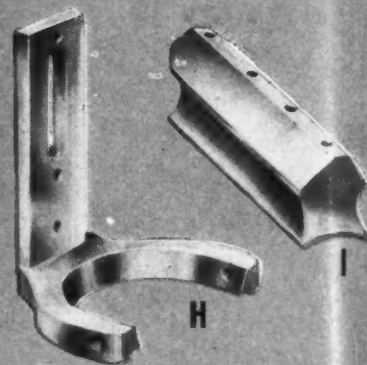
(A) Graduated fine adjustment button, (B) coarse adjustment button, (C) body tube nose adapter. All three are machined from Anaconda Free Cutting Brass Rod—an excellent base, incidentally, for their lasting chromium plate.



Anaconda Brass bar stock was used for this coarse adjustment rack (F), and the intricately form-milled intermediate slide block (G).



(D) Fixed eyepiece tube and (E) body tube are made of Anaconda Seamless Brass Tubes and machined with fine-pitch threads.



This unusual shaped fork-type substage mounting (H) is economically produced as an Anaconda Pressure Die Casting. And by using an Anaconda Hot Pressed Forging for this body slide member (I), which is silver soldered to the body tube, both metal and machining time are saved.

Cross-section of the optical system of a Spencer Polarizing Microscope, a product of American Optical Company, Scientific Instrument Division, Buffalo, New York. This instrument is used widely in many branches of science and industry for studying the structure of materials—fibrous, granular, crystalline, powdered or colloidal.

Anaconda Copper & Brass



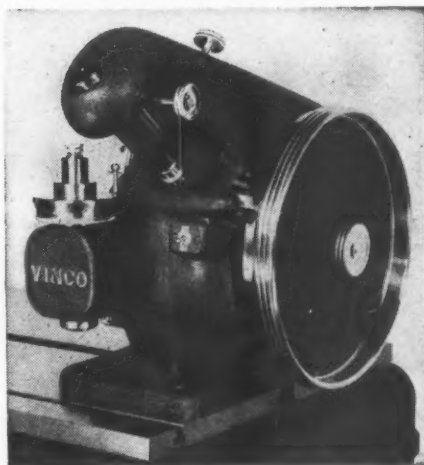
Send for
Bulletin
No. 55

30 Times MORE ACCURATE

What does that mean to you? It means that this proven accuracy is available to you for the inspection of gear teeth, master index plate notches, splines, cams and any other form of angular spacing. It means that final assemblies involving gears, cams, splines, etc., will be subject to less scrapage, because angular spacing errors will have been found and corrected.

Vinco guarantees the OPTICAL MASTER INSPECTION DIVIDING HEAD to be accurate within two seconds of arc; the master disk graduations to be spaced to an accuracy within ONE SECOND of arc; and the ball bearing spindle runout to be within TWENTY-FIVE MILLIONTHS of an inch, total indicator reading (the majority of spindles have less than fifteen millionths runout).

The fact that the VINCO OPTICAL MASTER INSPECTION DIVIDING HEAD has become firmly established throughout industry in such a short time is proof of its dependability and industrial necessity. The following pages cite one of many actual cases where the VINCO OPTICAL MASTER DIVIDING HEAD played a vital role in the production of a toothed part.



Below is the dividing head proper, showing the micrometer, scope, and hand wheel.

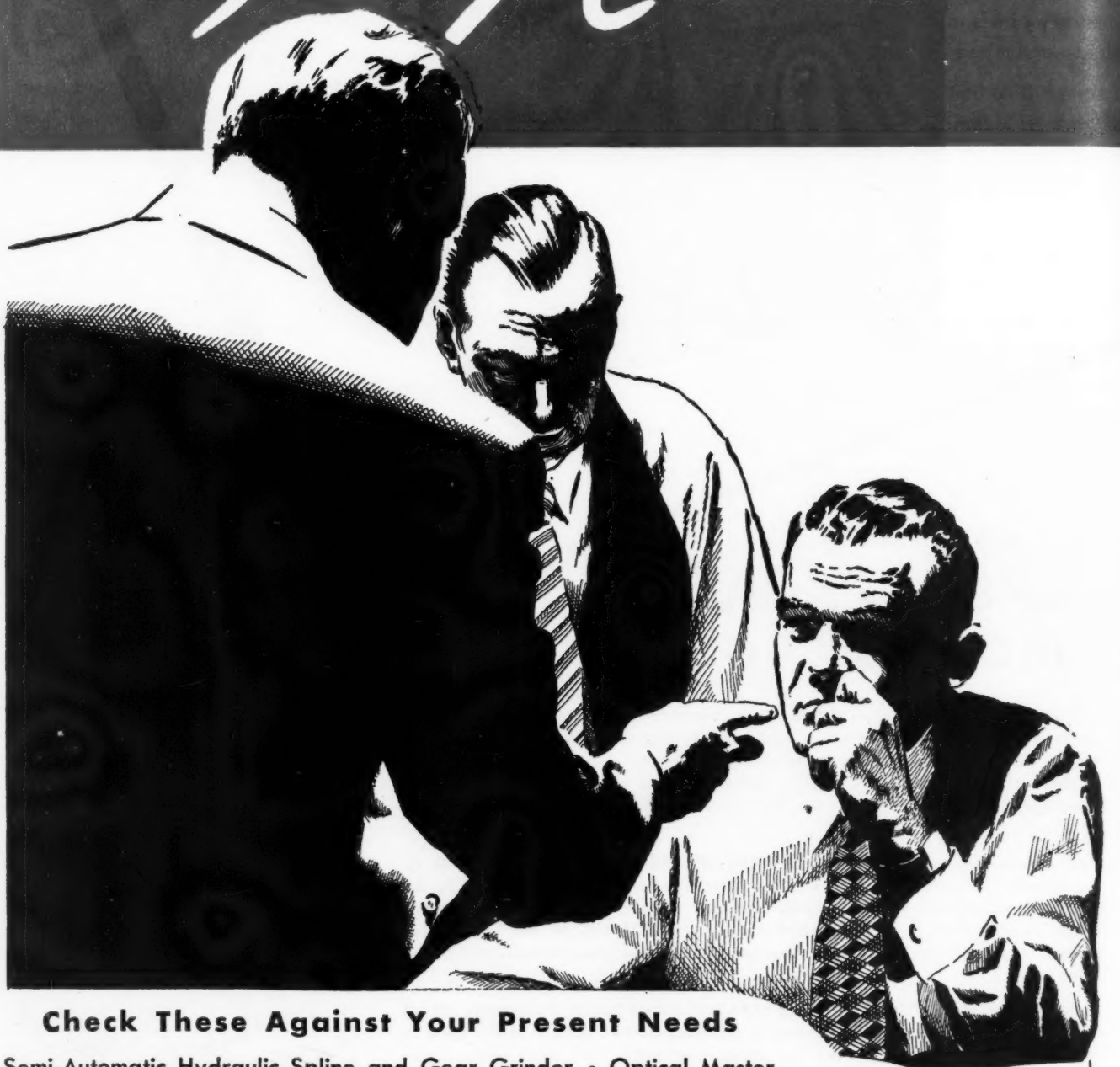
MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8853 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

They Came to



Check These Against Your Present Needs

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Roller Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

VINCO

BECAUSE THEY WERE STUMPED BY A REAL "TOUGHY"

It wasn't unusual! This group of production engineers, representing a large eastern manufacturer, had used our precision production service before and were well acquainted with Vinco methods and Vinco results.

Their request was not an ordinary one however! We were asked to produce, in quantity, mating toothed parts with 18 slots, each slot .017" in width with a tolerance of .0003" and a root diameter held to a uniformity of .0001".

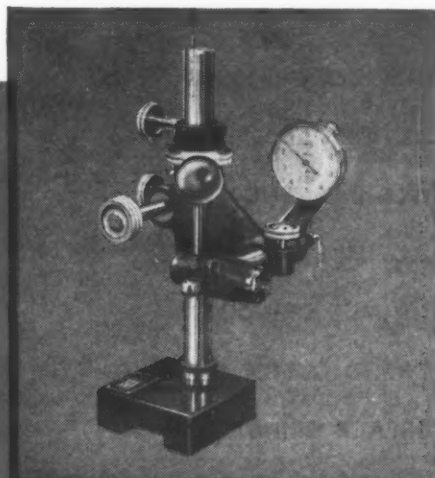
These parts were produced exactly as specified and were delivered on time and in quantities over and above specified requirements. We cite this one instance only because it is informative. Our long experience in the production of precision instruments and finely finished gages has given us a decided edge on precision production methods and techniques. Equipment and machines of our own design and make, in the capable hands of highly skilled operators, an engineering force thoroughly grounded in every phase of precision design and construction and a sales organization made up of men who combine a full engineering background with a wide and intimate knowledge of the trends and developments in the industrial field are all valid reasons for a further inquiry regarding this important phase of modern production.

Precision parts by Vinco meet your specifications. Give us the chance to prove it.

The Vinco Standard Indicator Surface Gage

Features of this gage include a .0001" custom built, full jeweled, dial indicator—differential adjusting screw for final settings—1½" to 12" work height range—full 360 degree swing of indicator head—readings can be taken on upper or lower surfaces.

Extreme accuracy and flexibility of operation all combine to make this standard indicator gage practically indispensable wherever rapid and close inspection of surfaces is required. (Incidentally, it was used regularly for checking the job mentioned above.) We designed these indicator gages for use with the Vinco Optical Master Inspection Dividing Head, but because of increasing requests they are now offered for general sale.



Vinco Universal Dividing Head

Developed by Vinco to handle light machining or grinding, this universal dividing head played a vital part in the manufacture of the "toughy". A ratio of 1440 to 1 between handle and work spindle provides an extremely high degree of spacing accuracy, even when using standard commercial dividing head plates.

The dividing head can be mounted either vertically or horizontally. It features a large diameter spindle mounted in a double row of Vinco designed ball bearings, a tapered spindle nose for work adaptors, a face plate of 11" diameter, a graduated dial on the spindle for initial settings, an auxiliary resetting dial and a 11.459" pitch diameter helical gear index plate with 360 accurately spaced teeth.



TO HANDLE COMPLEX TOOL GRINDING JOBS

with maximum speed and convenience

use **G & L's GRAND RAPIDS No.4**

Universal Cutter and Tool Grinder

EXTREME FLEXIBILITY of the No.4 Universal Cutter and Tool Grinder permits two ways of performing nearly every operation: 1. With the spindle head locked, the sleeve and knee swivel around the column; 2. With the sleeve locked the head swivels on the column.

VERSATILITY of the No.4 Universal Cutter and Tool Grinder makes all of the following grinding jobs practical and simple:

GEAR CUTTER GRINDING

ANGLE CUTTER GRINDING

INTERNAL GRINDING

CYLINDRICAL GRINDING

FACE GRINDING

FACE MILL GRINDING

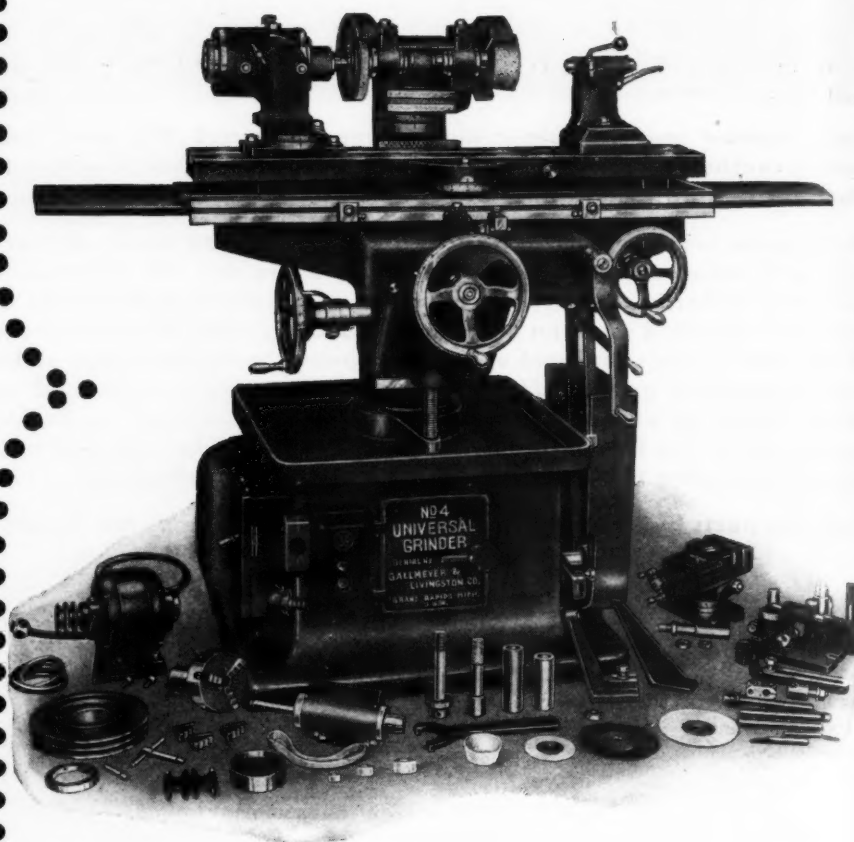
END MILL GRINDING

FORMED CUTTER GRINDING

SURFACE GRINDING

HOB GRINDING

Write for Bulletin 544



CONVENIENT OPERATION permits control of machine from either front or rear. Power feed providing 6 longitudinal table speeds and wet grinding are available.



What "GRAND RAPIDS" Quality Means: G & L cast their own close-grained gray iron, machine all parts to micrometric tolerances, and precision-assemble grinding machinery of unsurpassed performance. *Grand Rapids* means *top* quality in grinding machinery.

GALLMEYER & LIVINGSTON CO., 305 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

"With Gulf Electro Cutting Oil

we get more production
per tool grind"

says this Foreman



Actual photo of a Machine Shop Foreman (right) consulting with a Gulf Lubrication Service Engineer on results with Gulf Electro Cutting Oil in machining various parts on automatic screw machines.

"When we switched to Gulf Electro Cutting Oil, we noted an immediate improvement in the overall efficiency of our automatics," says this Foreman. "We credit this oil particularly for a big increase in production per tool grind—it helps keep our tools sharp."

Gulf quality cutting oils can give you a vital advantage in machining efficiency that may help you make substantial cuts in unit production

costs. Here's the important reason: Every Gulf cutting oil has specific properties which insure better performance on certain types of jobs!

It will pay you to get the complete story of the advantages of Gulf cutting oils. Call in a Gulf Lubrication Service Engineer today and let him show you how they can help you improve your machining practice. Write, wire, or phone your nearest Gulf office.



Gulf Quality Cutting Oils

Gulf Lasupar Cutting Oils A, B, and C
Gulf Electro Cutting Oils A, B and C
Gulf M-L Cutting Oils A, B, and C
Gulf Cut-Aid
Gulf Cutx B
Gulf L. S. Cutting Base A and B

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:

Boston • New York • Philadelphia • Pittsburgh • Atlanta
New Orleans • Houston • Louisville • Toledo

3900 Gulf Building, Pittsburgh 30, Pa.
Gulf Oil Corporation • Gulf Refining Company

M

Please send me, without obligation, a copy of the booklet, "Gulf Cutting Oils," which includes a helpful Machining Guide.

Name.....

Company.....

Title.....

Address.....

Multi-Section Hole Grinding in One Simple Set-up



Looking at this 10 station progressive die with 100 holes to be located and ground to .0002" tolerance in the die and stripper inserts, you'd hardly call it a single set-up job. But it is on the Moore Jig Grinder.

On this unique machine *all the sections can be screwed and doweled into place, strapped on the table and ground in one set-up...eliminating separate section hole grinding and the difficulty of accurately locating each section in the die bed.*

***Finish-grinds holes within .0001"
...straight or tapered***

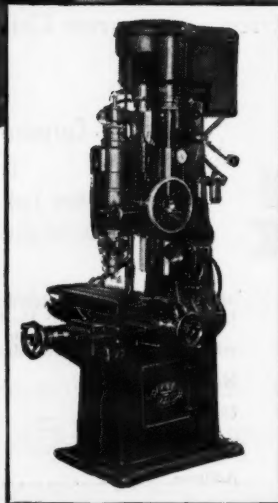
Hardening distortion is quickly and accurately corrected. The Jig Grinder relocates holes, finish-grinds them—straight or tapered, within .0001"—removes the decarburized surface and produces a smoother finish. All this in *one-third* the time required by previous, more costly methods. And more uniform clearance between punch and die adds from 25% to 100% to the life of a Moore jig-ground die.

You'll want to know more about what this machine can do for you, why it is considered a toolmaker's "must," how the Moore Jig Grinder put die-making on an interchangeable parts and assembly basis. So write today for our technical bulletin.

MOORE SPECIAL TOOL CO., INC.
734 UNION AVENUE, BRIDGEPORT 7, CONN.

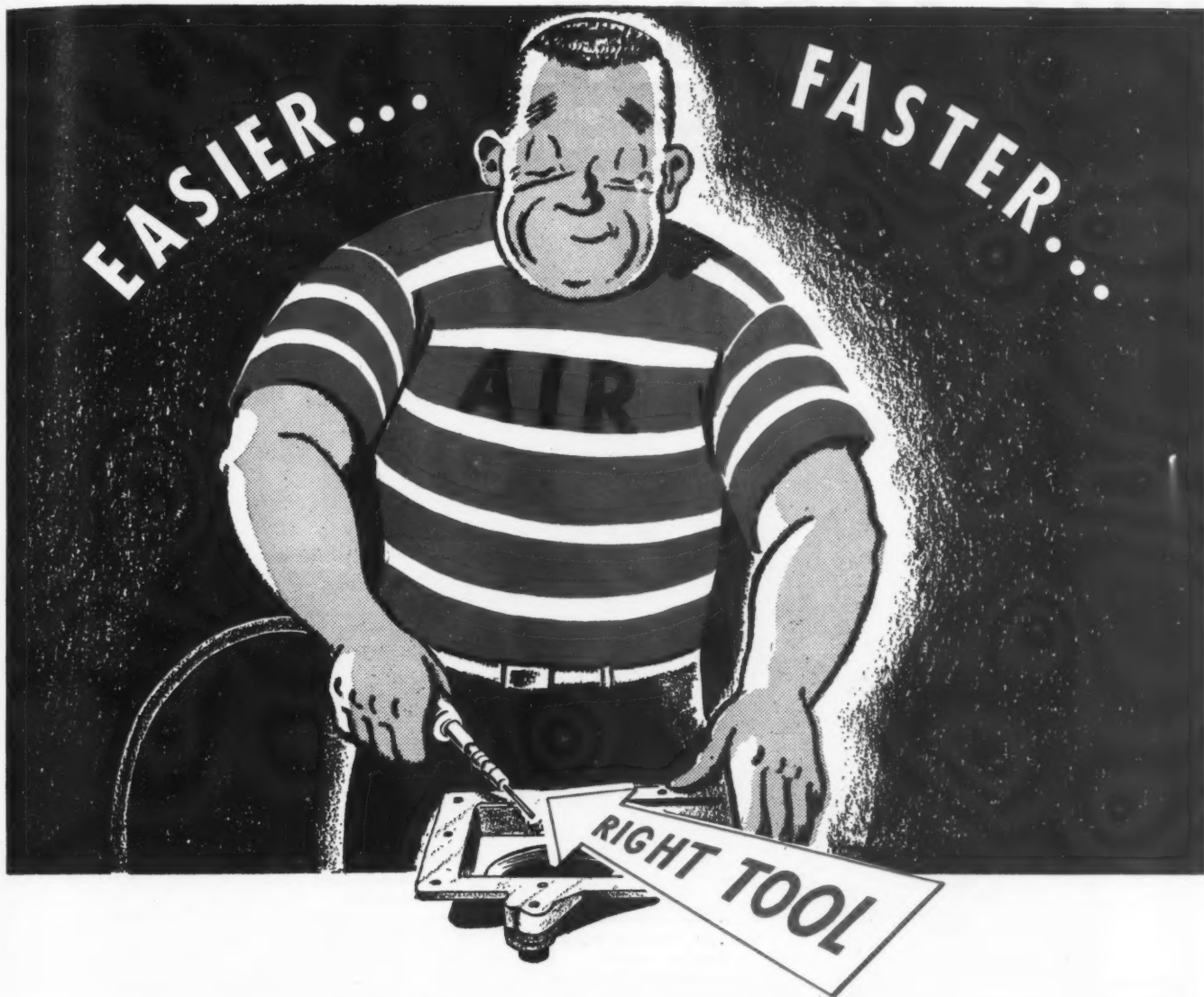


MOORE



Jig Grinder

THE ONLY MACHINE OF ITS KIND



CUTS COST 50%

HAND files and scrapers were being used by this manufacturer of railroad equipment for filing sharp machine edges and burrs on bronze castings. The Rotor Application Engineer suggested doing it the easy way with a Rotor M-827 midget grinder with rotary file. This 20,000 R.P.M., 1½ lb. Rotor air tool was installed and gave these results:

50% reduction in burring costs because high-speed, light-weight Rotor midget file doubles production compared to former hand operation.

A more uniform, smoother finish because this rotary power file is easy to handle and reaches places inaccessible with hand files.

Perhaps you have hand filing operations which could be done quicker and better with these high-speed, light-weight tools. Let the Rotor Application Engineer suggest ways to decrease your costs by increasing your output per man per dollar.

Yours for smoother filing,

AIR O'TOOL



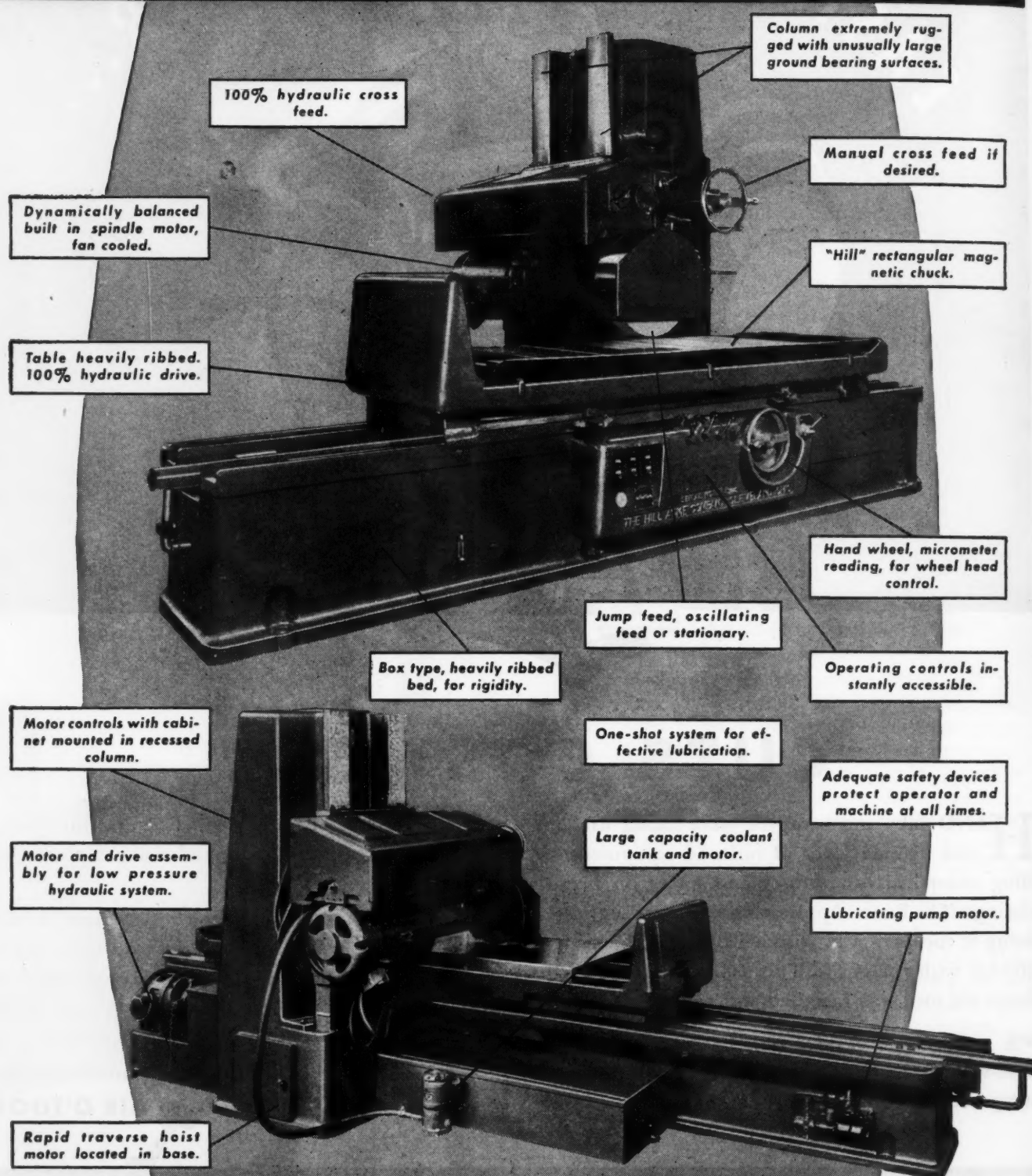
THE **ROTOR TOOL** CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

HILL SURFACE GRINDERS

"Open Side" Horizontal Spindle Hydraulic grinders for heavy duty precision grinding. Also built in Vertical Spindle design and in a full range of table widths and lengths.



THE HILL ACME COMPANY

6400 BREAKWATER AVENUE • CLEVELAND 2, OHIO

"HILL" HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING • TAPPING MACHINES
"CANTON" ALLIGATOR SHEARS AND PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES AND SHEAR BLADES

NOTHING LIKE BEING PREPARED!



Even a carefree youngster knows the value of preparedness! Then surely a production-minded shopman should at all times be prepared for emergencies.

You never can tell when a milling machine arbor might suddenly break down, causing vital production schedules to be disrupted and machine hours wasted. So be prepared! Keep several spare arbors on hand for emergencies. Remember, arbors are classed as "perishable tools" and their cost today is relatively small.

KempSmith Arbors in all popular sizes and types are regularly carried in stock. Every one is a precision-built tool, adaptable to ANY make of milling machine equipped with standardized spindle. Fill in and mail coupon for bulletin.

THE KEMPSMITH MACHINE CO.

1821 S. 71st Street • Milwaukee 14, Wis., U. S. A.

KempSmith Arbors are backed by more than a half century of specialized experience in designing and producing rugged milling machines and accessories.

Buy Your Arbors from an Arbor Specialist

KEMPSMITH

Precision Built Milling Machines Since 1888

Write Today!

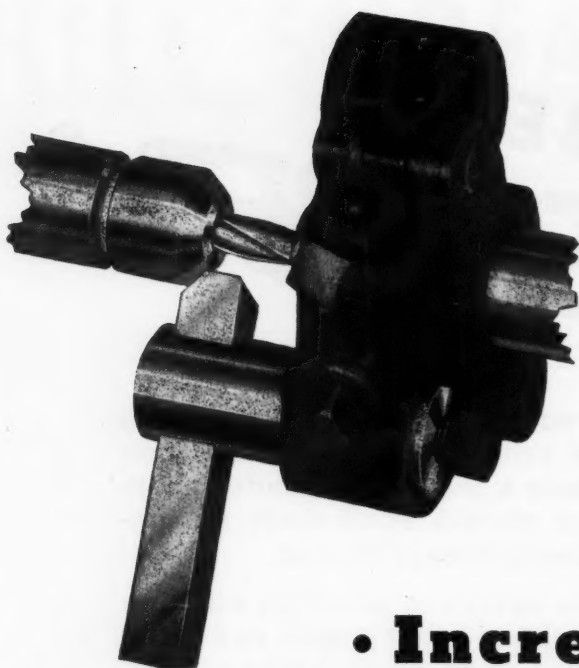
KEMPSMITH -- Yes, I would like to receive a copy of your new Arbor Bulletin:

NAME _____

TITLE _____

FIRM _____

ADDRESS _____



• Increase Production Capacity the R and L Way!

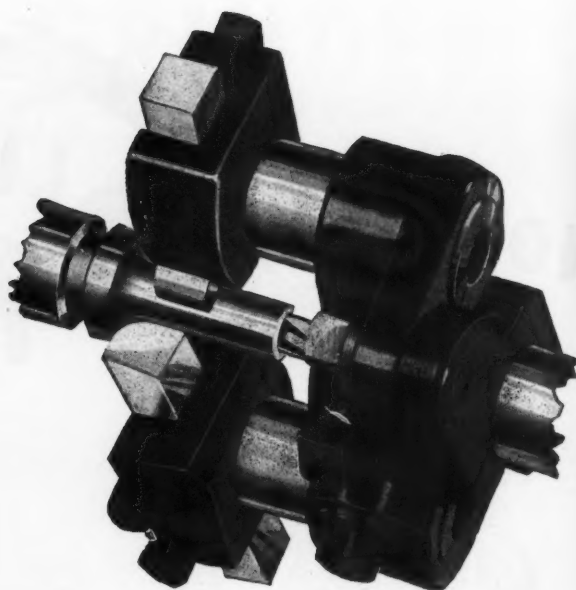
Looking for ways to increase your production capacity?... Quick ways? Put R and L Turning Tools on your turret lathes and screw machines, and double (or triple) the capacity of each spindle or turret face! With R and L Turning Tools it is easy — and practical — to set up combinations of two or three operations like the ones illustrated, speeding up intricate jobs, assuring concentricity and saving production time. In addition, the single, simple R and L Turning Tool replaces a dozen or more separate tools, and can be changed in ten seconds from right- to left-hand operation, so that you save in tool costs, too. Built in five sizes to cover a wide range of jobs. R and L Turning Tools are constructed of heat-treated alloy-steel, with all essential parts ground to provide accurate alignment.

Look over the typical set-ups shown. Can you use similar toolings to speed up operations in your plant? If you can, write for complete details of R and L Tools, given in the idea-packed R and L Booklet.

R AND L TOOLS

1825 BRISTOL STREET — NICETOWN — PHILADELPHIA, PA.

54—MACHINERY, June, 1946



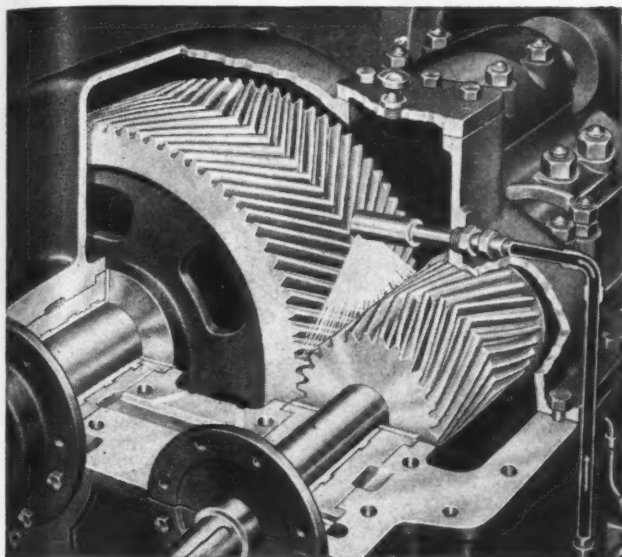
ABOVE, LEFT: R and L Turning Tool set up for drilling and chamfering in one operation.

ABOVE: Turning part with large radius while drilling. Tantalum carbide backrest set to support work over straight turned diameter.

BELOW: Turning one diameter, chamfering two corners, facing end of part along with drilling or reaming.



Are you shipping or storing valuable machinery?



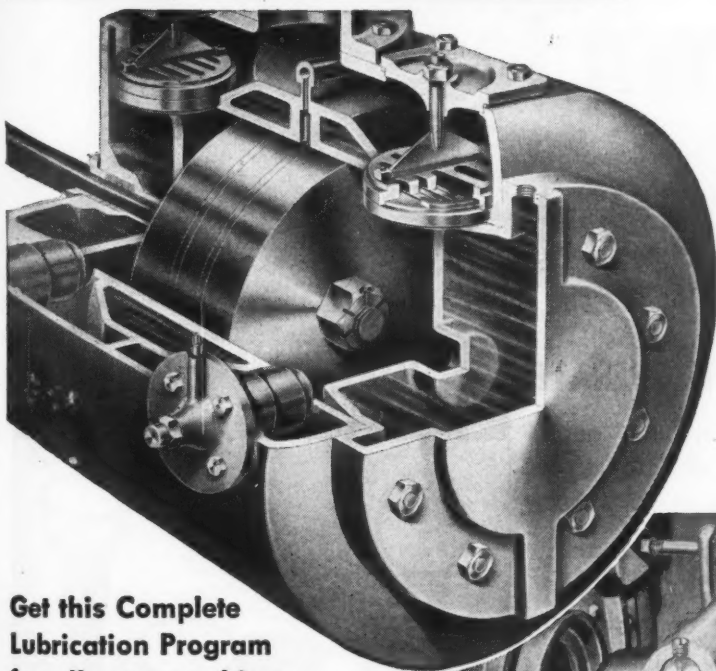
Here's new "inside" protection against rust!

SOCONY-VACUUM has developed two new rust preventives to protect the internal surfaces of intricate machinery during storage and shipment.

The new products, S/V Sova-Kotes 501 and 503, are applied in the same manner as regular lubricating and hydraulic oils. They possess sufficient stability and lubricating properties to permit their use for "run-in" applications.

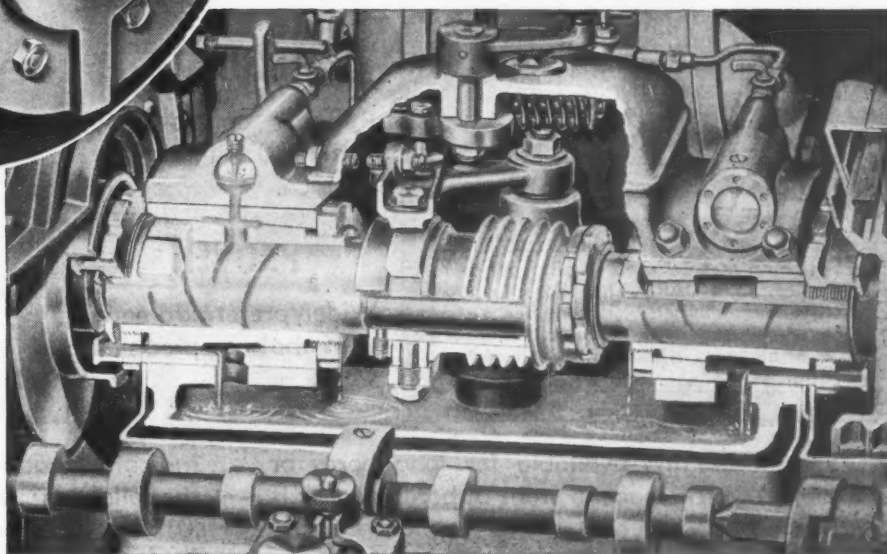
Tests show 30 to 40 times greater protection against rust than regular operating oils. Complete information on correct application are available now in a special Socony-Vacuum bulletin. Get your copy now from your local Representative.

RUST IS WASTE
Sova-Kote your
metal



Get this Complete
Lubrication Program
for all your machines

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained.



Socony-Vacuum Oil Co., Inc.

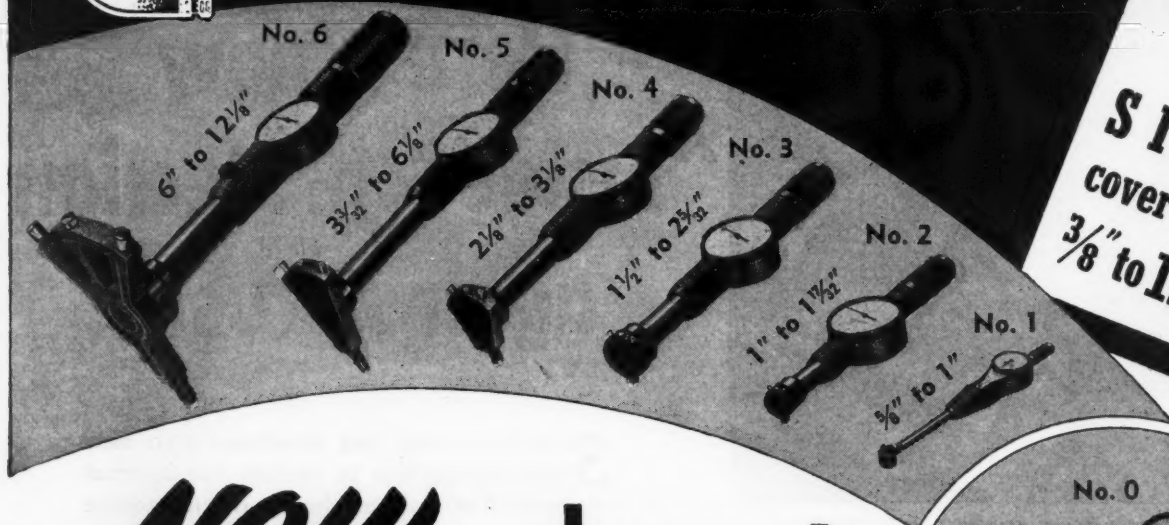
and Affiliates: Magnolia Petroleum Co., General Petroleum Corp. of Calif.

TUNE IN "INFORMATION PLEASE" MONDAY EVENINGS, 9:30 E.D.T.—NBC

MACHINERY, June, 1946—55

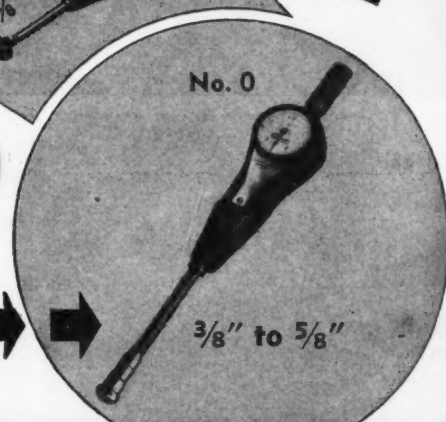


STANDARD DIAL BORE GAGES



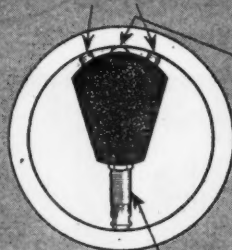
**7
SIZES**
cover range
3/8" to 12 1/8"

**NOW...down to
3/8" bore** → → → →



STANDARD Centralizing Mechanism

CENTRALIZING PLUNGERS



GAGING
PLUNGER

DIAMETER EXTENSION

Positioning method used in all types and sizes of STANDARD Dial Bore Gages. Centralizing plungers work together; keep line of measurement through center of bore at all times, whether gage is inserted at angle or not.

EASY TO OPERATE

Just insert the gage, rock it, and take the reading.

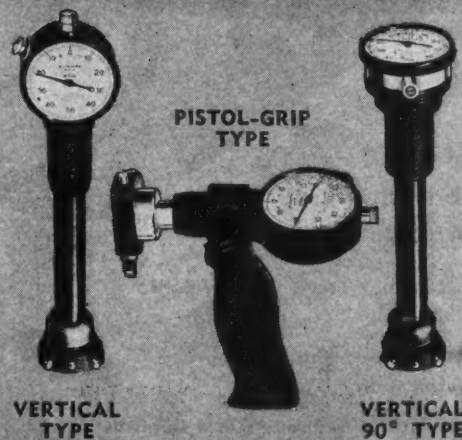
ACCURATE

Repeats consistently within 20 millionths of an inch.

PROVEN

Widely preferred among men who know precision work.

DIFFERENT TYPES to fit different jobs. Dimensions above 1"



VERTICAL
TYPE

PISTOL-GRIP
TYPE

VERTICAL
90° TYPE

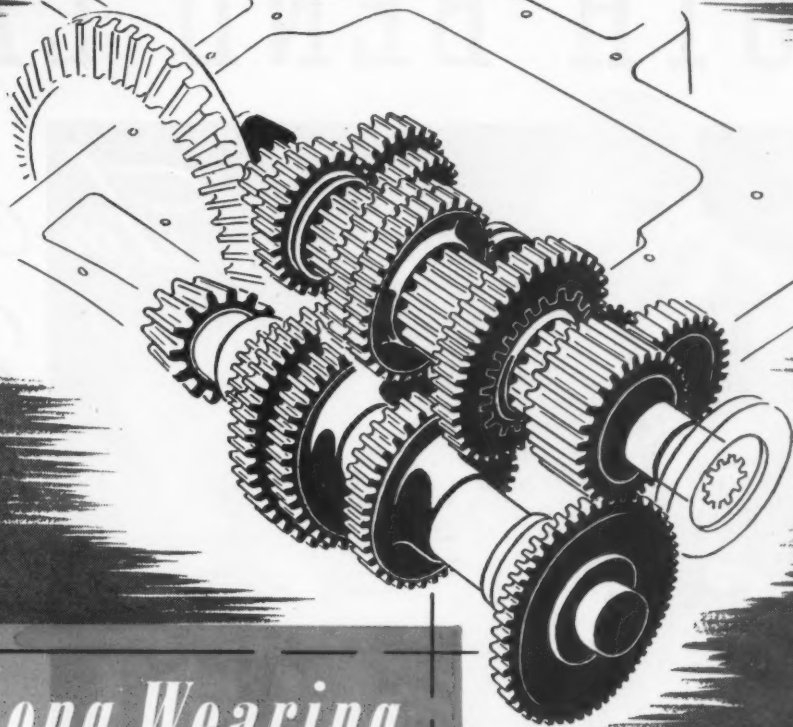
Special lengths available for long bores or jobs in which space in front of bore opening is limited.

Indicator graduations may be selected from the following: .001", .0005", .0001", .00005", .01 mm, .005 mm, .002 mm, .001 mm.

WRITE FOR CATALOGUE A



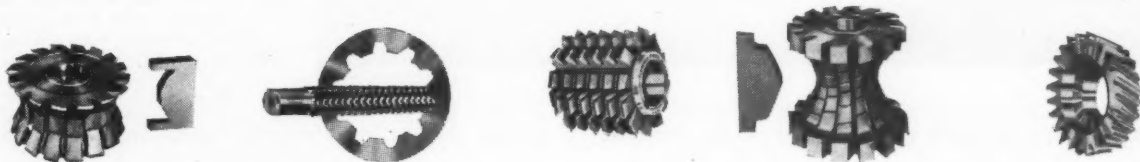
STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.



Quiet... Long Wearing

ENGINEERED BY ILLINOIS TOOL

Having designed and made hobs for producing all types of gears in practically every industry, our engineers are ready to help you solve such important problems as tooth design, proper checking procedures and machining methods.



HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

**ILLINOIS
TOOL WORKS**

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS



2501 N. Keeler Avenue, Chicago 39, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

Ships to all America from
the hub of air transportation.

SOUTH BEND LATHES



*For Accuracy
Versatility
Dependability*



TELESCOPIC TAPER ATTACHMENT
For 10", 13", 14½", and 16"
South Bend Lathes

This and other South Bend Lathe Attachments and Accessories permit quick tooling for a wide variety of precision machine work. Write for free Catalog 77. No obligation.

South Bend Lathes combine three distinguishing features which have won for them the acclaim of discriminating machine tool users everywhere:

» Accuracy that permits working to close tolerances and machining work with such smoothness that often one or more finishing operations can be eliminated.

» Versatility to perform a wide variety of precision operations easily, quickly, and economically that otherwise

would require installation of additional equipment.

» Dependability achieved through careful design and rugged construction assures day-in, day-out, trouble-free performance at low cost long after the installation has repaid its original cost.

Write today for Catalog 100-D which illustrates the entire line of South Bend Precision Lathes in full color and gives complete, detailed specifications of each model.

SOUTH BEND LATHE WORKS

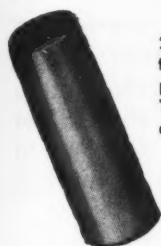
424 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

LATHE BUILDERS SINCE 1906



2500 PER HOUR

Valve stem ends TOCCO-hardened to depth of $\frac{3}{16}$ ". Hardness of 50 Rockwell "C" accurately controlled.

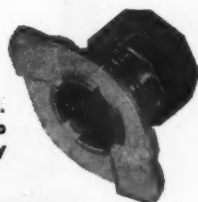


2000 PISTON PINS PER HOUR. Continuous hardening of carburized piston pins to 62 Rockwell "C". Pins TOCCO-hardened free of distortion and scale.

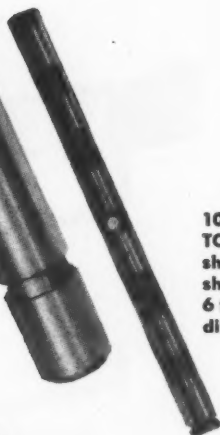
300 AXLE SHAFT BEARING RACES PER HOUR. Hardens axle bearing to 62 Rockwell "C". Eliminates inner race formerly pressed on. Gives 50% more strength.



500 DISTRIBUTOR CAMS PER HOUR. Cam surfaces TOCCO-hardened to 62 Rockwell "C" after assembly eliminating copper plating.



100 ROCKER SHAFTS PER HOUR. TOCCO-hardened at six areas per shaft. TOCCO fixture accommodates shafts 14" to 36" in length, having 6 to 12 hardened areas. No scale or distortion.



FOR TODAY'S TEMPO:

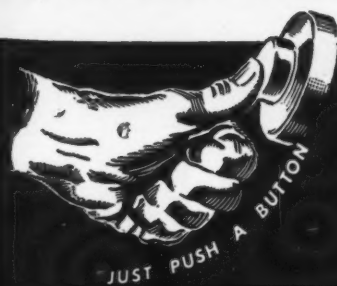
Get this **SPEED** and **VERSATILITY** with a Standard TOCCO Unit



Speedy, accurate TOCCO Induction Hardening enables you to produce better products, faster, *at a fraction of the cost of* conventional heat-treating. One manufacturer gets such results for 142 different parts . . . with one standard TOCCO machine! Fixtures are readily changed, permitting quick tool-up to suit the job.

Find out how TOCCO's speed and versatility can help solve *your* problems and save *you* money. "Results with TOCCO" free for the asking.

THE OHIO CRANKSHAFT COMPANY • Cleveland 1, Ohio



JUST PUSH A BUTTON

TOCCO

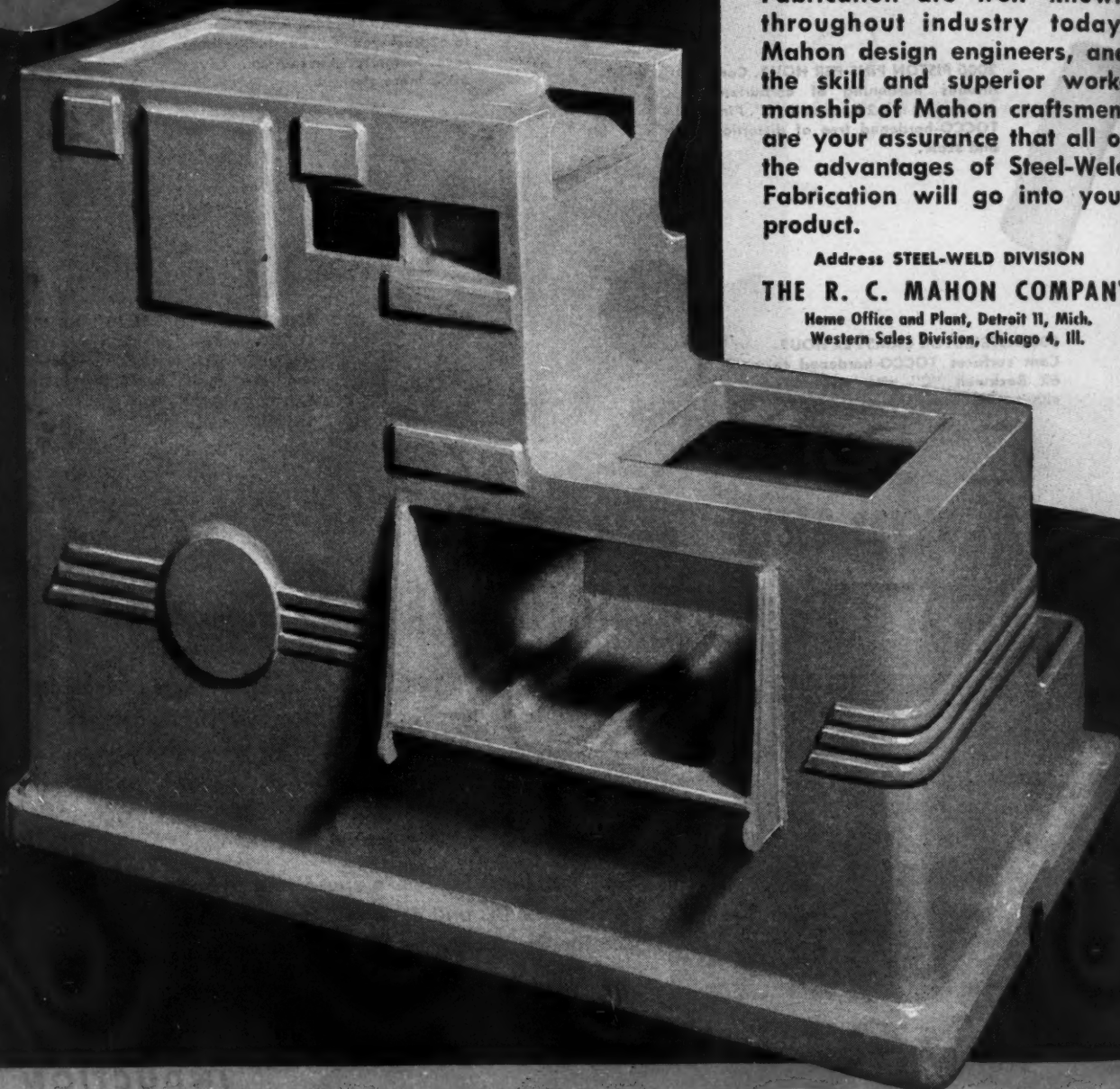
INDUCTION

HARDENING, BRAZING

ANNEALING, HEATING

Steel-Weld

FABRICATION



The advantages of Steel-Weld Fabrication are well known throughout industry today. Mahon design engineers, and the skill and superior workmanship of Mahon craftsmen, are your assurance that all of the advantages of Steel-Weld Fabrication will go into your product.

Address STEEL-WELD DIVISION
THE R. C. MAHON COMPANY
Home Office and Plant, Detroit 11, Mich.
Western Sales Division, Chicago 4, Ill.

MAHON

Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products



Surface Broaching

TONGUES AND GROOVES

Serrations, slots and all types of concave and convex curved surfaces are being surface broached on Footburt machines, in most cases at remarkable savings in costs over previous machining methods. Send blueprints of your parts with hourly production requirements. We will be glad to study your machining problem and make recommendations on the use of surface broaching.

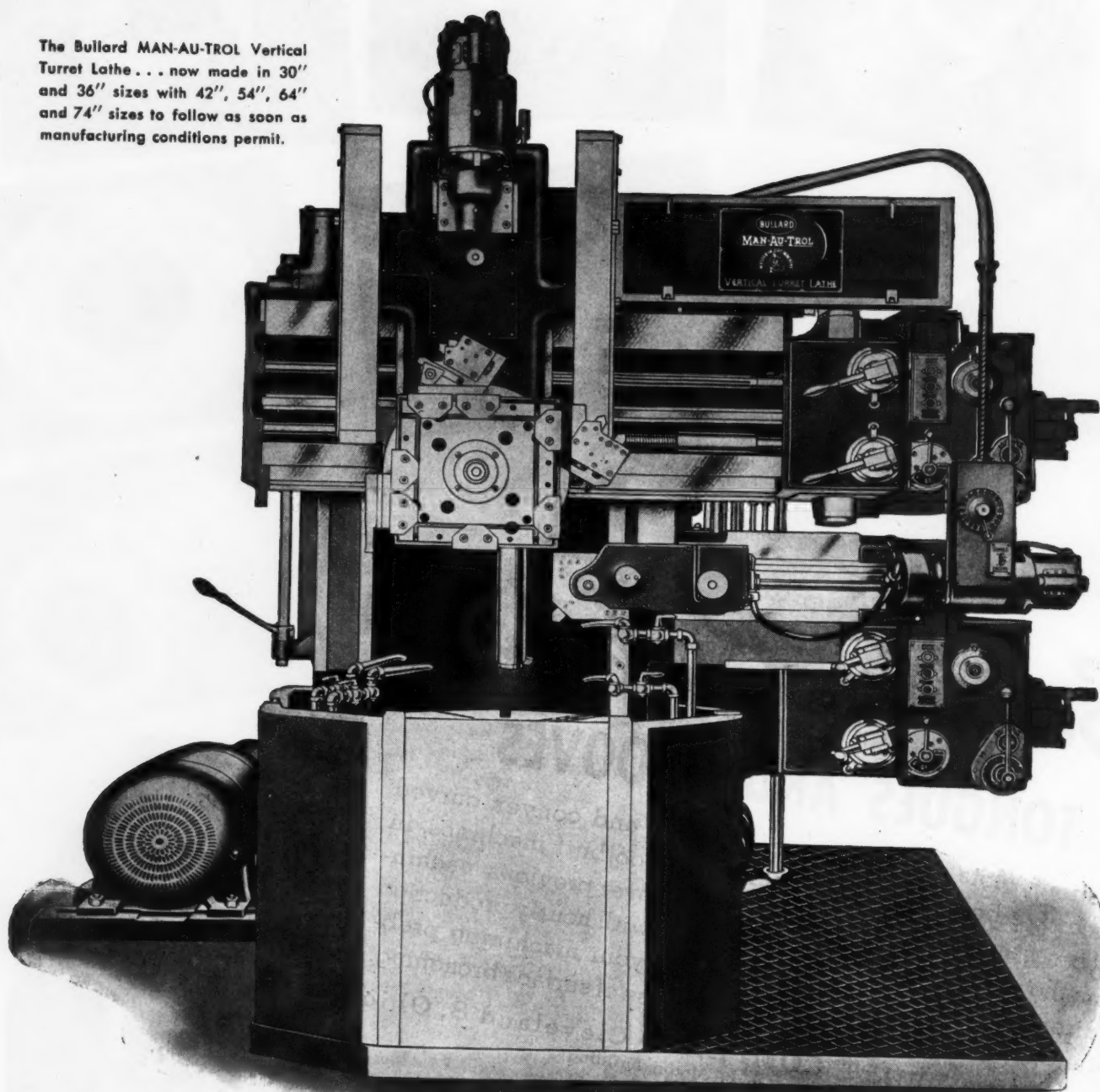
THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building



Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

The Bullard MAN-AU-TROL Vertical Turret Lathe . . . now made in 30" and 36" sizes with 42", 54", 64" and 74" sizes to follow as soon as manufacturing conditions permit.



How short a run can an automatic machine handle efficiently?

NOW . . . one piece or thousands!



BULLARD CREATES NEW METHODS

The reason is ...

BULLARD

MAN-AU-TROL

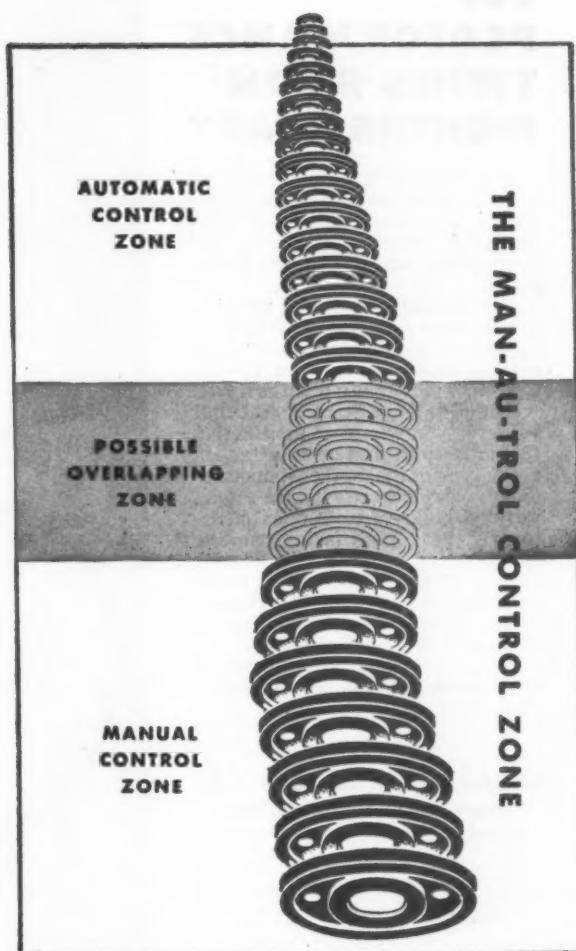
The automatic control that is as versatile as manual control

Now an automatic machine can be kept busy on short or long runs if it's a Bullard MAN-AU-TROL machine.

The Bullard MAN-AU-TROL principle of automaticity makes one machine both an automatic machine and a manually-controlled machine. On short runs, you can operate it manually. On longer runs ... about 10 or more pieces ... you can set it up quickly and easily for 100% automatic operation.

Such unique versatility provides greater efficiency for diversified shop schedules ... lower unit costs to meet modern economic needs.

At present, MAN-AU-TROL is being built into Bullard machines only.



The proof is ...

BULLARD MAN-AU-TROL *Vertical Turret Lathe*

See how the Bullard MAN-AU-TROL Vertical Turret Lathe solves production problems that are on your mind these days:

1. Lightens Labor's Load because the operator machines the first piece under manual control while easily setting the operations for automatic cycle ... then merely loads, supervises and unloads when MAN-AU-TROL's 100% automaticity takes over.

2. Makes One Machine Do More because it automatically machines any class of work within manual-control range

... is instantly convertible to manual operation on the same or a different piece without affecting the automatic cycle.

3. Cuts Automatic Set-Up Time because set-up time from one class of work to another is only slightly more than for a manually-operated machine.

4. Reduces Spoilage because it operates continuously to a degree of accuracy no manual operator can duplicate.

Engineering data and other facts on the Bullard MAN-AU-TROL Vertical Turret Lathe are yours for the asking. Write for Bulletin MAV-G-1 today. The Bullard Company, Bridgeport 2, Connecticut.

TO MAKE MACHINES DO MORE

TOP PERFORMANCE TWIN BORN MONTHS APART

Bay State's "fractional grading" — three degrees of hardness within the usual grade — and "controlled porosity" permit micrometer adjustment in fitting the grade to the grind.

That's why you can be sure top performance will be repeated 100% by each wheel made to your original specifications — even though they are made many months apart.

There's a Bay State Wheel that will give you complete satisfaction the first time and ever after, in every type of tool and cutter sharpening. Bay State's extra-strong vitrified bond permits open structures — for cooler, faster grinding — while for other needs a wide variety of organic bonds are available. And Bay State's "Koolpore" wheels are unbeatable on high speed steels and cemented carbides.

Let us know your grinding wheel requirements. We'll send bulletins with detailed information.

**BAY STATE
ABRASIVE PRODUCTS CO.**
3 Union Street, Westboro, Mass.
Canadian Plant: Brantford, Ontario

GRINDING WHEELS



HONING AND SUPERFINISHING

STONES



PORTABLE SNAGGING

WHEELS



MOUNTED WHEELS AND



POINTS



CUT-OFF WHEELS

INSERTED-NUT DISCS



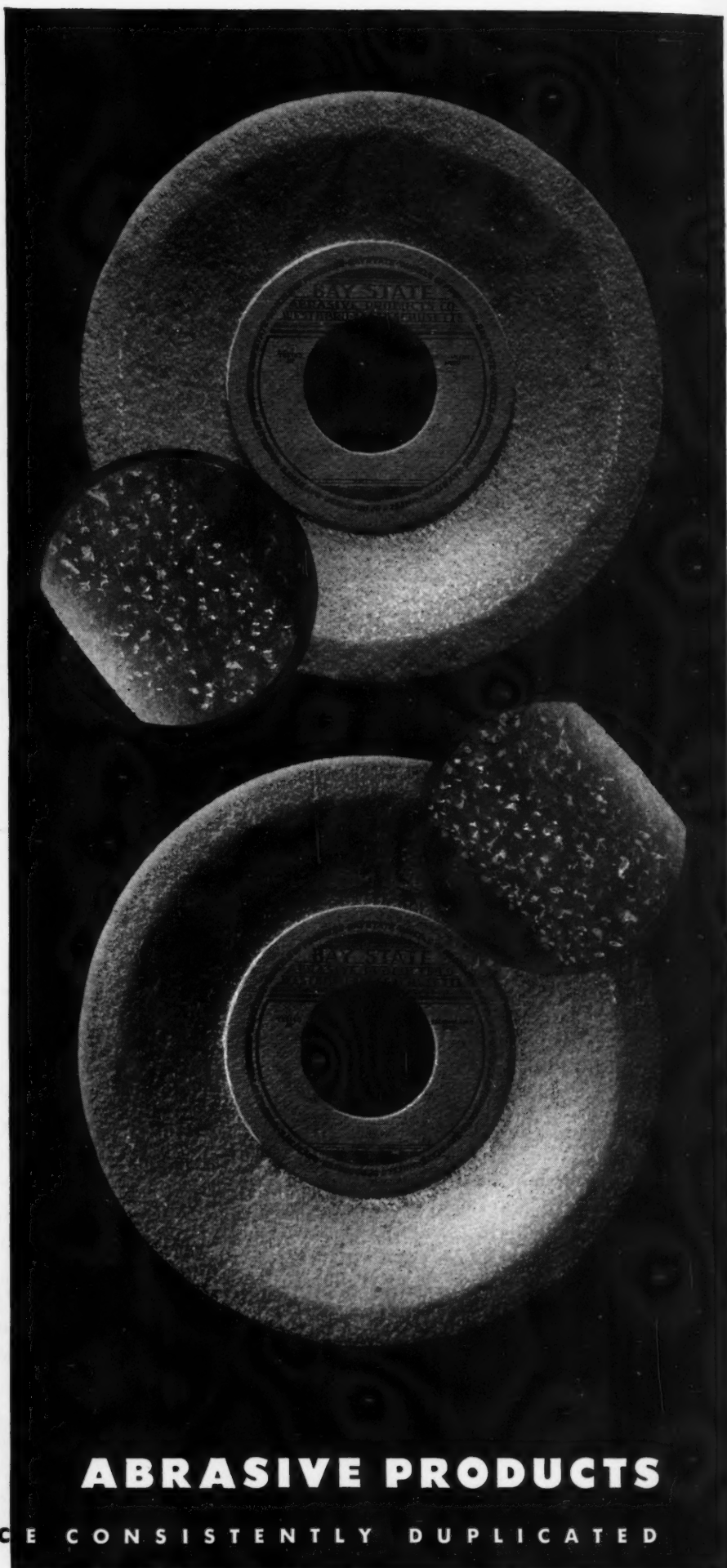
AND



CYLINDERS

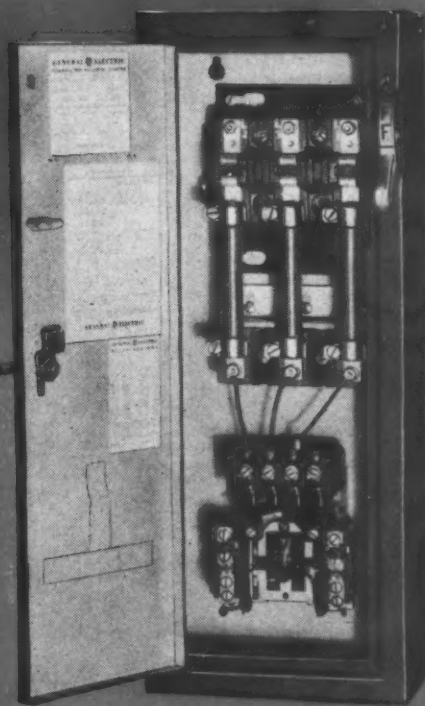
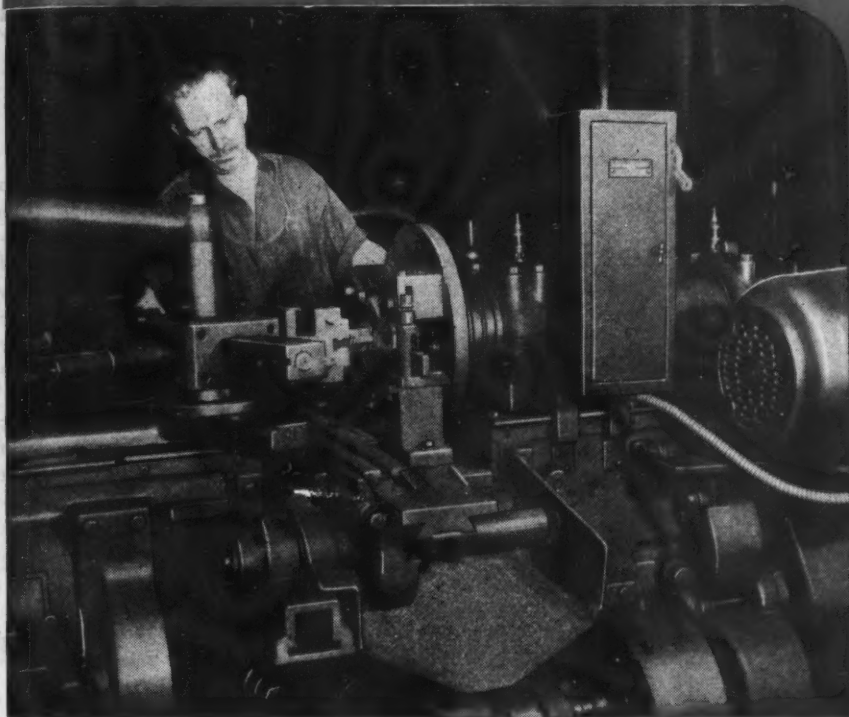
**BAY
STATE**

TOP PERFORMANCE CONSISTENTLY DUPLICATED



ABRASIVE PRODUCTS

300 G-E COMBINATION MOTOR STARTERS...



...give White Motor Company real
protection...save time, money, too.

Magnetic starter and motor-circuit switch in *one* unit—G-E “combination” motor starters of this type give co-ordinated control to over 300 machines in the White Motor Company plant in Cleveland.

The starter shown above is installed on a lathe used in making water pumps. Others control drill presses, shapers, boring mills, grinders, and many other types of machines.

Here's Why the Combination Starter Was Chosen

- Fast-acting overload relays protect the motor controlled from overheating—and fuses protect it from damaging short circuits.
- Safety for operators is assured by interlocking doors. While the power is on, the door cannot be opened.
- Quick servicing and availability of repair parts is made possible by G.E.'s broad network of sales outlets.

Wide Field of Application

This motor company represents just one of the many different industries in which G-E combination starters are at work today. Why not give the advantages of these compact, time-saving starters to *your* plant. Our engineers will be glad to help with your application. Get in touch with our local office today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL  ELECTRIC
676-200-8910

HOW YOU SAVE...

... TIME. Instead of buying two devices, you order and install only one. Mounting time is cut as much as 40 per cent.

... SPACE. Compact combination starters can be mounted in small unused places near to or remote from the operator.

... MONEY. The list price is slightly more than for two separate devices, but the difference is more than made up by savings in wire, conduit, and fittings.

MORE INFORMATION about combination starters is given in our Bulletin GEA-3715A. Ask our local office for your copy.



For Real Belt Savings . . . Buy the Belt on the REEL !

"Packaged" Veelos On Reels Saves Money...Time...Space

Nothing causes more time-loss and confusion in the stockroom than a hodge-podge of V-belts in assorted sizes. Switch to Veelos—the link V-belt that's "packaged" on plywood reels—and replace chaos with order. A handy reel—holding 100 feet of belt—is stored in minimum space . . . any length V-belt for any size drive is quickly uncoupled . . . money that would be tied up in a large spare

stock is saved . . . belt waste due to deterioration is eliminated because of more efficient, economical turnover when all lengths are uncoupled from a single reel—right at the machine . . . long work stoppages are ended by the ease and speed with which any required length of Veelos can be coupled on the drive.

The combination of Veelos link construction and the packaging of Veelos on reels has brought V-belt up-to-date . . . provides important advantages to users. The details are worth knowing—write today for full information.

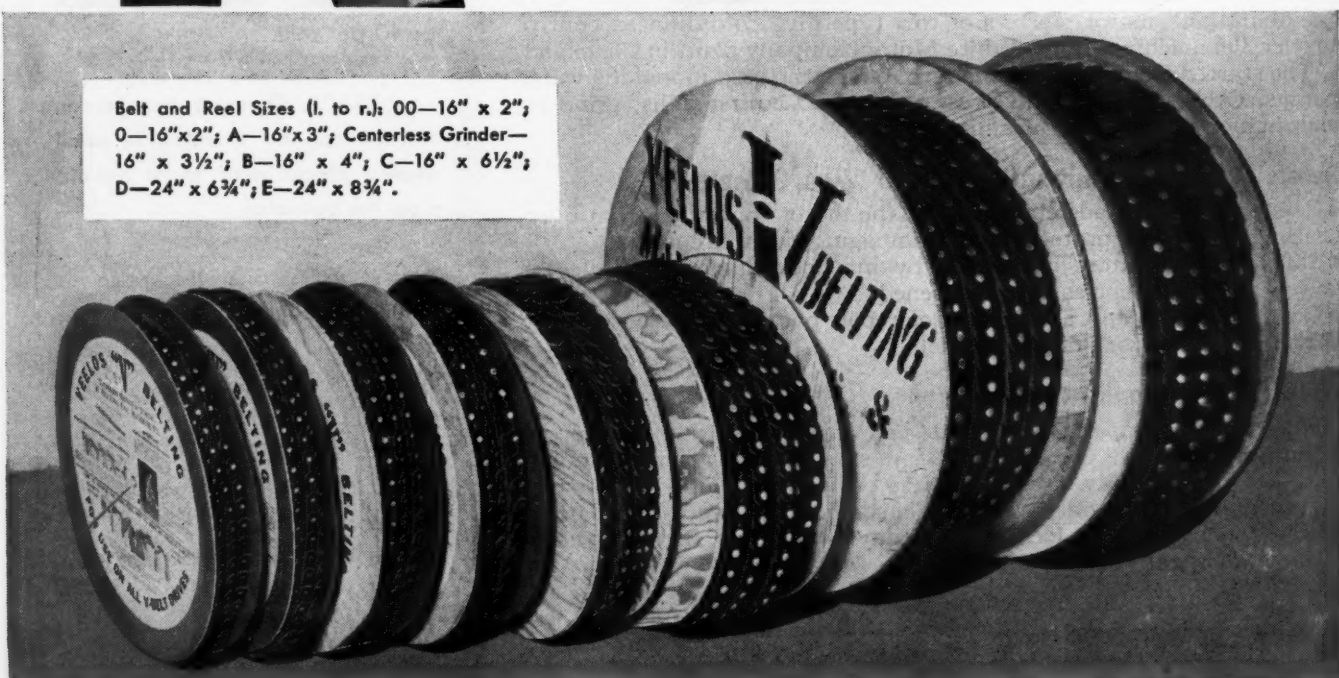
MANHEIM MANUFACTURING & BELTING CO.
546 MANBEL ST., MANHEIM, PA.

LINK CONSTRUCTION
UPS PRODUCTION

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

Belt and Reel Sizes (l. to r.): 00—16" x 2";
0—16" x 2"; A—16" x 3"; Centerless Grinder—
16" x 3½"; B—16" x 4"; C—16" x 6½";
D—24" x 6¾"; E—24" x 8¾".



Van Keuren



MICROGAGES

A FOUNDATION FOR ACCURACY FOR 25 YEARS

VAN KEUREN MICROGAGES are high precision working gages, designed for use on all ordinary work and economically practical for use in production because of their low cost. Their great value in general shop use lies in the fact that they enable the workman to achieve the accuracy required by the inspector.

MICROGAGES are of first quality oil hardening alloy tool steel, exceptionally hard, carefully seasoned, with accurately flat and parallel mirror-like surfaces. They combine readily by wringing together and because of their size (11/16" dia.) are ideally suited for checking heights, widths, slots, machine set-ups, gage setting and many other uses. They are made round in order to assure the best distribution of wearing surface, which is about equal to that of rectangular gage blocks.

MICROGAGES up to 1" in length have a tolerance of plus .000015" minus .000010". They average 5 millionths of an inch oversize which provides the WEAR ALLOWANCE feature of these gages.

VAN KEUREN MICROGAGES are available in sets especially designed for general shop use, for gage setting and for toolmakers and machinists. Individual MICROGAGES in standard sizes are also available in a size up to 6" in length.



Set MTT MICROGAGES.
35 Gages giving 140,000
combinations. ... \$95.00



Set MT MICRO-
GAGES. Over
5,000 combina-
tions in thou-
sandths. \$35.00.



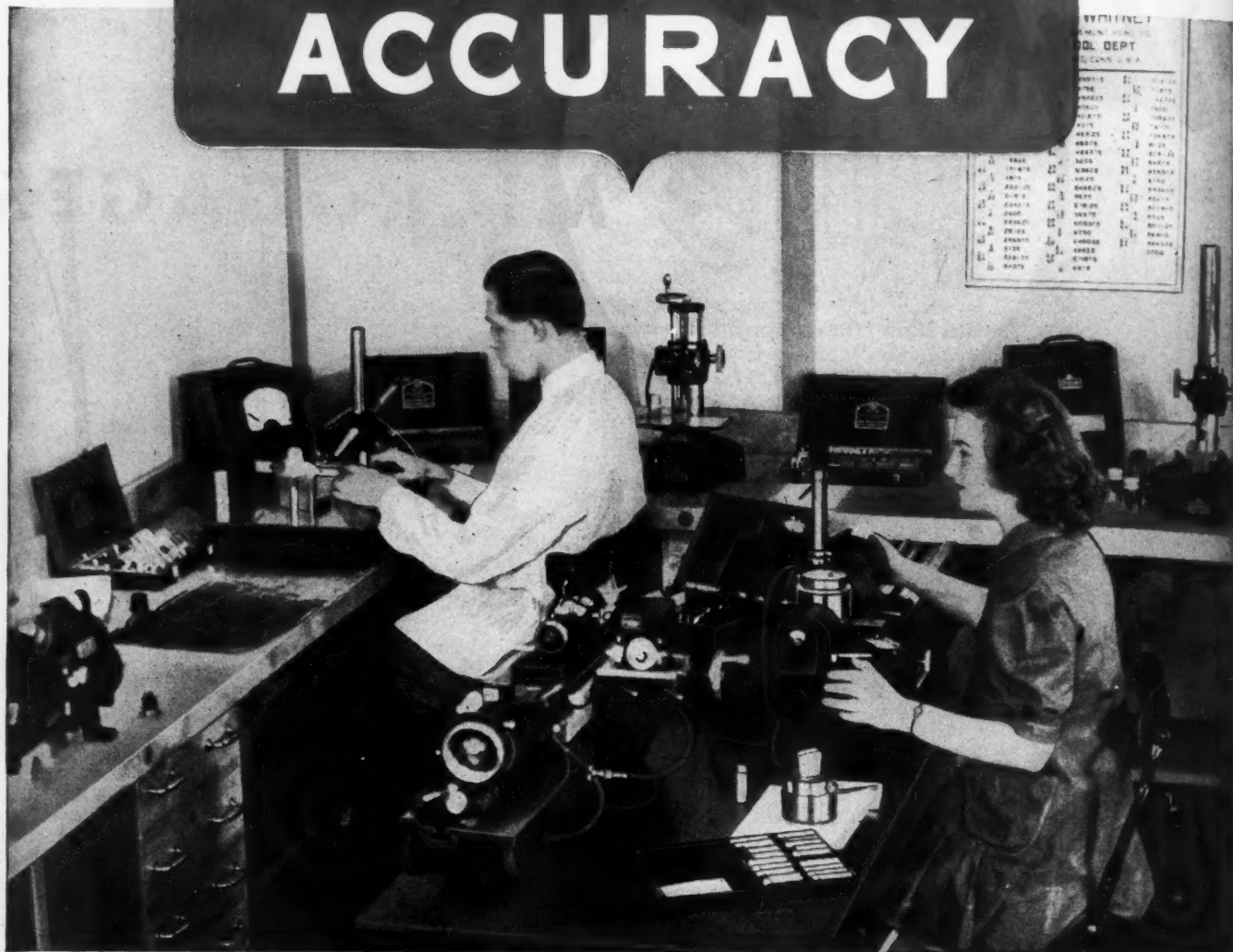
Toolmakers MICRO-
GAGE SET M64.
Gives 121 combina-
tions. \$15.00

Complete details on MICRO-
GAGES and the full line of
Van Keuren Precision Measur-
ing Tools are contained in
Catalog No. 33, a 160-page
manual for toolmakers, ma-
chinists and inspectors—send
promptly on request.



Van Keuren

How to Maintain ACCURACY



Somewhere in every shop, whether large or small, is a place devoted to precision measurement. Whatever its size, this measuring control is one of the most essential places in your plant.

The importance of precise measurement increases as the tolerances become closer. Industry is finding out that when the working limits have been selected and adhered to properly, the product will assemble easily and quickly, thus lowering the production cost.

The war set new standards of measurement. Peacetime competition may require even higher ones.

What are today's

CRITERIA OF MEASUREMENT?

If you are seeking the answer to this question, or if you are planning a "Standards Room" for the control of measurement in your plant, we want you to have this new booklet.

"Criteria of Measurement" is illustrated in full color. It tells you how to set up your own central measuring laboratory and describes the basic measuring equipment that will be needed in it.

Write for "Criteria of Measurement" on your firm letterhead.



PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT



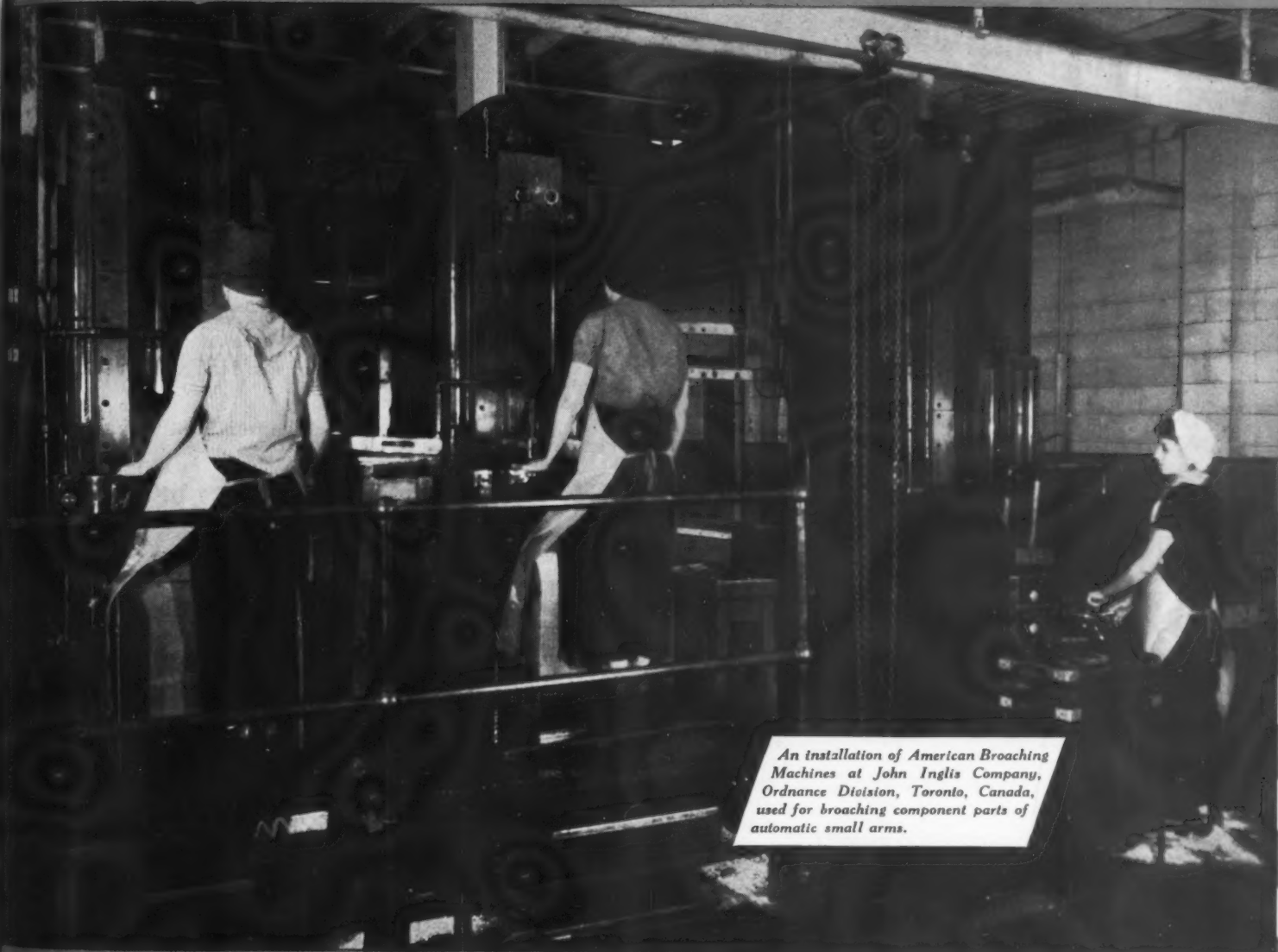
June, 1946

ROCKFORD

Metalworking

ROCKFORD

Production Ideas



An installation of American Broaching Machines at John Inglis Company, Ordnance Division, Toronto, Canada, used for broaching component parts of automatic small arms.

AMERICAN BROACH & MACHINE CO. ★ ANDERSON BROS. MFG. CO. ★ BARBER-COLMAN COMPANY

Div. of Sundstrand Machine Tool Company

BARNES DRILL CO. ★ JOHN S. BARNES CORP. ★ W. F. & JOHN BARNES CO.

GREENLEE BROS. & CO. ★ MATTISON MACHINE WORKS ★ REHNBERG-JACOBSON MFG. CO.

ROCKFORD CLUTCH DIVISION ★ ROCKFORD MACHINE TOOL CO. ★ SUNDSTRAND MACHINE TOOL CO.

Emp-Wheeler Corporation

Machinery, June, 1946

Hy-Draulic



TAMING A "TOUGHIE"

The job on the 48" Rockford Hy-Draulic Openside Planer shown above would be a "toughie" to plane economically without this handy machine. The work consists of a pair of 84"-long cast iron saddles that have dovetails and bearing surfaces on opposite sides and at right angles to each other. Planing the saddles lengthwise is easy for any good 48" planer . . . and this Rockford Hy-Draulic Openside does a fine job on both saddles successively.

Planing the other side of these castings would require a larger and much more costly double-housing planer. On the 48" Hy-Draulic Openside the job remains easy

because the castings can overhang the planer table 40" or more, on the "open" side, without interference. Planing both sides of both saddles takes only 29.7 hours floor-to-floor. This is really "taming a toughie," considering the amount of planing, number of tool-settings, accuracy, high quality of finish and set-up time required.

Rockford Hy-Draulic Openside Planers are made in four capacities and in various lengths up to 20 feet. They do first-class work on all ordinary planing and "tame" lots of "toughies" besides. Investigate these Rockford Hy-Draulic machines today. Write for Bulletin 1534.

ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS



MADE IN

ROCKFORD...TESTED ENGINEERING AND CRAFTSMANSHIP
ILLINOIS, U.S.A.

Machinery, June, 1946



THERE IS

*No
Substitute*

for HONING

These piston rods for recoil or recuperator cylinders are honed on a **BARNESDRIL** No. 5E Horizontal EXTERNAL Hydraulic Honing Machine. Rods are $4\frac{1}{2}$ " and $1\frac{1}{2}$ " diameters. Accuracy for uniformity. Accuracy for taper in these rods 8 feet long—within .0001" to .0002". Could be honed to zero, if necessary.

THIS PRECISION PRODUCTION PROCESS GIVES EXTREME ACCURACY AND SUPERIOR FINISH

Honing is applied to generate finished surfaces in cylinder bores or on external surfaces of certain cylindrical parts. Honing begins at the rough machined surface, cuts down to base metal quickly, then delicately completes final finish and establishes the required size precisely. Substantial amounts of stock are removed most economically at high speed. Honing, usually the final processing operation, corrects previous machining errors, while generating final size, accuracy and finish.

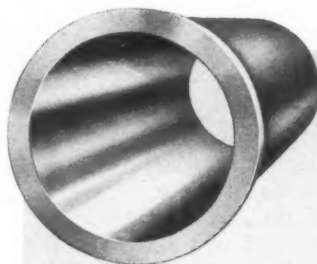
Honing *generates* (1) diameter roundness and (2) diameter straightness. Honing *corrects* (1) out-of-roundness and (2) taper.

BARNESDRIL HONERS AVAILABLE FOR A VARIETY OF INTERNAL AND EXTERNAL HONING APPLICATIONS...

BARNESDRIL hydraulically controlled Honers generate a true circle or diameter on a neutral axis as developed by boring or grinding. They will control and develop constant diameters and produce an extra fine finish.

BARNESDRIL Honers are fast and easy to operate. They give you maximum production at minimum cost; save time, labor, floor-space, work-handling, operator training; and many intermediate machining operations. A wide variety of sizes, with suitable equipment, are available in **BARNESDRIL** Vertical and Horizontal Honing Machines—Internal and External—to handle any size, length or kind of work that can be honed.

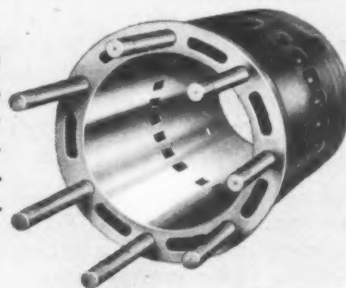
If you are not using the honing process today to secure precision accuracy, superior finish, higher production and greatest economy on your final finishing operations, **BARNESDRIL** engineers will show you how to adapt the honing process to your work. There is no obligation for this service.



$17\frac{1}{2}$ " diameter by 5 foot long Diesel engine sleeve honed on large **BARNESDRIL** No. 4030 Vertical INTERNAL Hydraulic Honer,

showing beauty of the surface finish to an accuracy of within .001" for roundness and straightness.

Diesel engine cylinder with studs set is honed on a **BARNESDRIL** Vertical INTERNAL Hydraulic Honing Machine, showing mirror smoothness of bore.



Send for this FREE Bulletin

No. M-121 which describes the Honing Process, with complete description of **BARNESDRIL** Honing Machines available for both internal and external honing.



Barnes Drill Co. 814 CHESTNUT STREET **ROCKFORD ILLINOIS, U.S.A.**



FOR RIGID ACCURACY IN MACHINE TOOLS... **ROCKFORD**

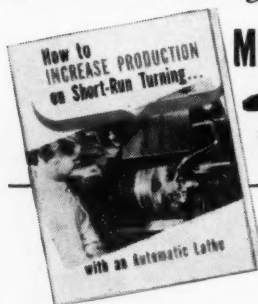
ILLINOIS, U.S.A.

How to apply Multiple Tooling and Automatic Cycling to **TURNING JOBS**

Whether your turning problem is a mass production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle changeover. They will also assist in designing the most profitable processing method for the job at hand.

All of the advantages of multiple tool turning are available for both short run and mass production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes.

Described here are three typical cases in which Sundstrand "Engineered" Production assisted plant engineers in designing a tooling method which resulted in lower turning costs.



MORE TURNING FACTS

Free

This 44 page booklet, crammed full

of technical data and production information shows how to apply multiple tooling to countless turning jobs. Short-

run, mass production and special turning jobs are all included. Write for your copy today. Ask for bulletin 649.



RIGIDMILS

FLUID-SCREW RIGIDMILS

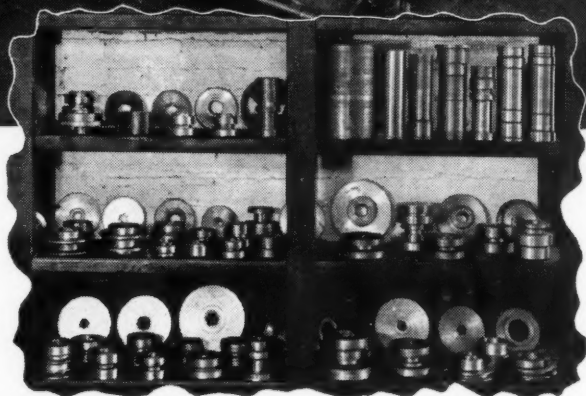
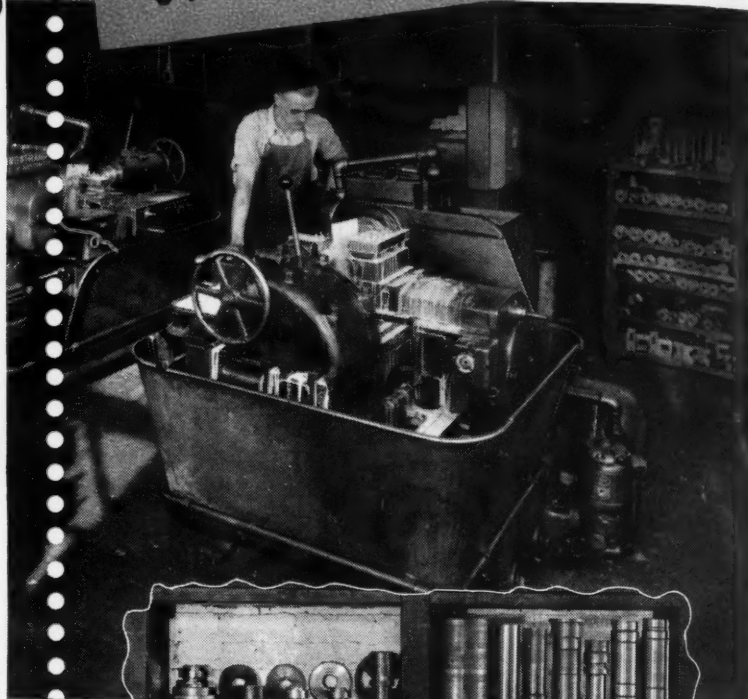
AUTOMATIC LATHES

HYDRAULIC EQUIPMENT

MADE IN
ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION
ILLINOIS, U.S.A.

Machinery, June, 1946

1 SHORT RUN TURNING

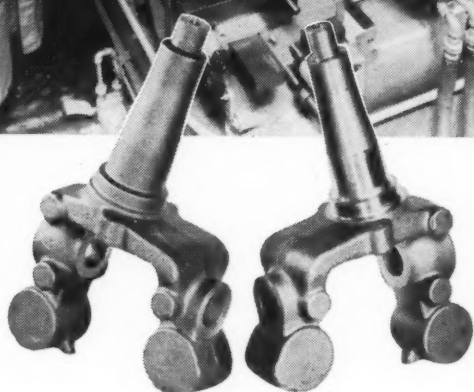
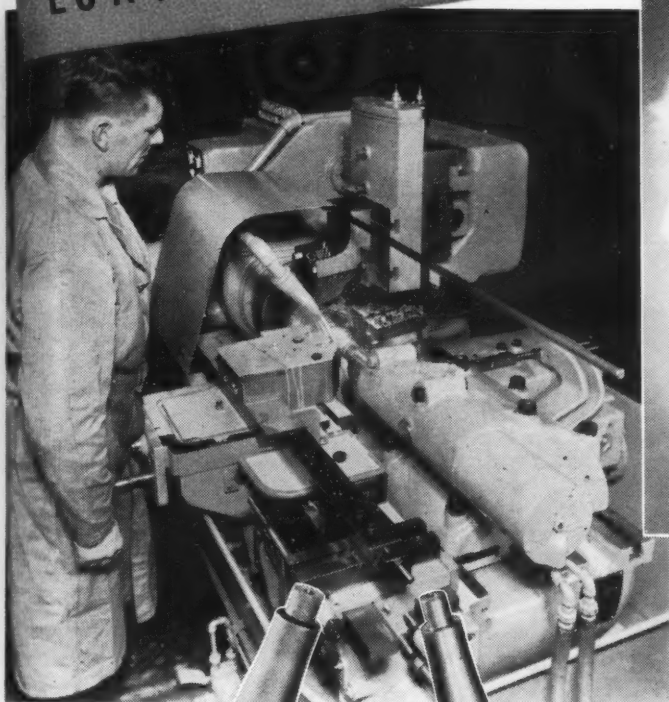


DUE to the quick changeover features of the Sundstrand automatic cycle, it is possible for this manufacturer to turn many of his jobs in lot sizes as low as 25. On one lot of 40 sleeves, his turning time was cut from 50 to 7 hours. Over 100 different parts are turned, including sprockets, pulleys, gears, etc., with lot sizes of 25 to 100 pieces.

Universal tool blocks, for adjusting tools to handle wide range of parts, keep tooling inventory to a minimum.



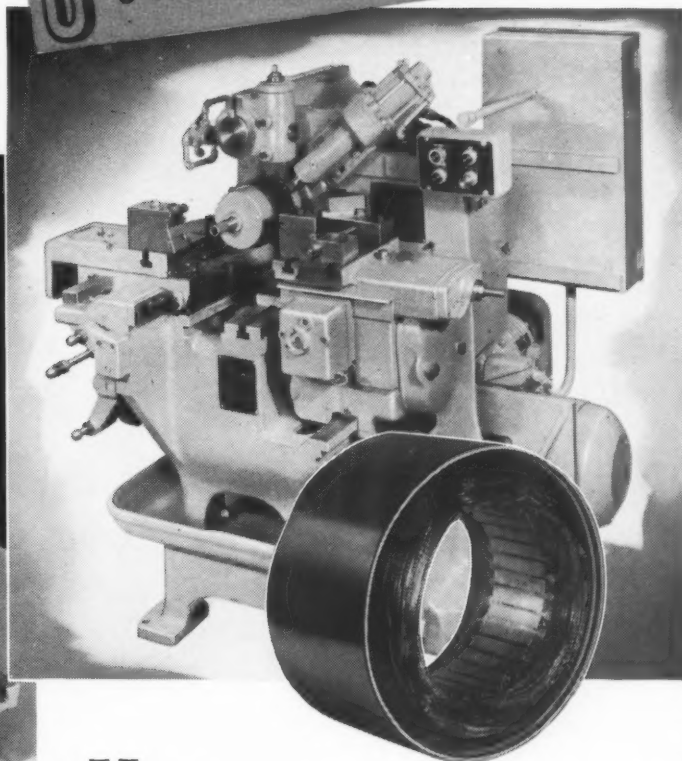
2 LONG RUN TURNING



SUNDSTRAND'S unique cycle control mechanism is remarkably simple and easy to adjust. Consequently, the time saved in setting up the machine is also desirable for turning long runs. Here's an example:

Six different steering knuckles are rough turned on this Sundstrand Model 12 Automatic Lathe. Operations include both straight and taper turning, facing and chamfering. With two complete sets of tool blocks, all parts are machined with a minimum of changeover time. Nine tools completely rough the stem end of the part in one machine cycle.

3 SPECIAL TURNING



HERE'S a special Sundstrand lathe which bores the I.D. of both ends, chamfers the I.D. and O.D. of both ends and faces the ends of a stator frame and coil assembly. Eight tools are used in this setup to complete the operation in one machine cycle. Machine and tool adjustments enable this equipment to be used on a number of different sizes of parts. A special short bed was provided so that operator position is convenient for loading, unloading and starting machine cycle.



**SUNDSTRAND
MACHINE TOOL COMPANY**

2530 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES

SPECIAL MILLING AND TURNING MACHINES



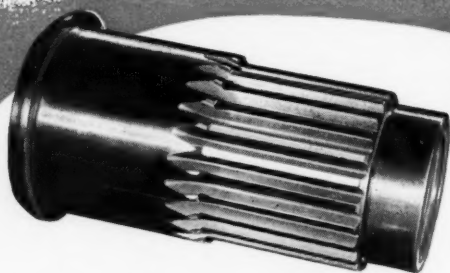
CENTER OF MACHINE TOOL EXCELLENCE...

ROCKFORD

MADE IN

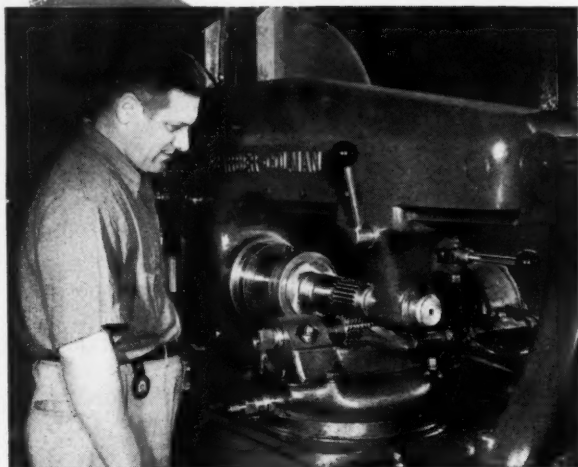
ILLINOIS U.S.A.

Machinery, June, 1946



Production Doubled

**on 24-TOOTH HARDENED SPLINE SHAFTS
... CONCENTRICITY HELD within .0005"**



**B-C TYPE D HYDRAULIC HOBGING MACHINE and
B-C HOBS GIVE EXCELLENT PRODUCTION RESULTS
and EXCEPTIONAL TOOL LIFE**

Hobbing time was cut 40 minutes over previous methods when a Barber-Colman Type D Hydraulic Hobbing Machine and B-C ground hobs were used in rough and finish hobbing operations, on 24-key splines, requiring heavy stock removal. Exceptional accuracy was achieved in the production of a complete piece in two successive cuts. The shafts were held concentric on pitch line within .0005".

These 24-tooth involute spline drive shafts (SAE 4140 steel, 28-32 Rockwell C) are hardened before hobbing. The B-C hobs are sharpened every 10 pieces... an exceptionally good tool life in view of the heavy stock removal and number of teeth cut.

FOR SUBSTANTIAL SAVINGS IN PRODUCTION TIME

The Barber-Colman Type D Hydraulic Hobbing Machine combines many exclusive hydraulic and mechanical features which make it easy to run and simple to set up. It has the extra rigidity to give new high production capacity and greater accuracy. Accuracy can be repeated consistently within fractional thousandths of an inch.

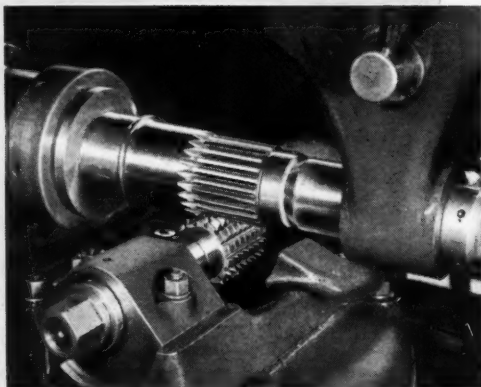
Designed to handle a wide range of general hobbing work, this hobbing machine cuts spur or helical gears, splines, or special forms. Large, heavy cuts are handled as easily as regular-run hobbing jobs.

With a long record of precision accuracy and uninterrupted service, the B-C Type D Hydraulic Hobbing Machine offers these distinct advantages: (1) low cost operation; (2) increased production and longer hob life; (3) automatic cycling in production; (4) fast set-up and change over; and (5) completely controlled accuracy.

Barber-Colman Hobbing Service helps you to obtain the utmost economy in your hobbing operations. Consult your nearest B-C Hobbing Engineer who will assist you in the selection of the B-C Hobbing Machine and Hobs best suited to your individual work requirements. There is no charge for this service.

JOB RECORD

Name of Part — Involute Spline Drive Shaft
Material — SAE 4140, 28-32 Rockwell C
Operation — Rough and Finish Hob 24 involute spline keys
2-13/16" long, 8/16 pitch
Machine — Barber-Colman Type D Hydraulic Hobbing Machine
Hob — Barber-Colman Ground Hob; 3" diameter; 3" long; 1-1/4" bore
Feed — .300" per minute, rough hobbing
.200" per minute, finish hobbing
Speed — 129 r.p.m.
Production Time — 30 minutes per piece (2 cuts)
No. of Pieces per Sharpening — 10
Accuracy — Shafts held concentric with pitch line within .0005" and fit ring gauge



Write Today . . .

for Bulletin F-1477 which describes completely, the B-C Type D Hydraulic Hobbing Machine. This bulletin will be sent FREE on request.



HOBGING MACHINES,
HOBS, HOB SHARPENING
MACHINES, REAMERS,
REAMER SHARPENING
MACHINES, MILLING CUT-
TERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

GENERAL OFFICES AND PLANT • 109 LOOMIS ST. • ROCKFORD, ILL., U.S.A.



MADE IN

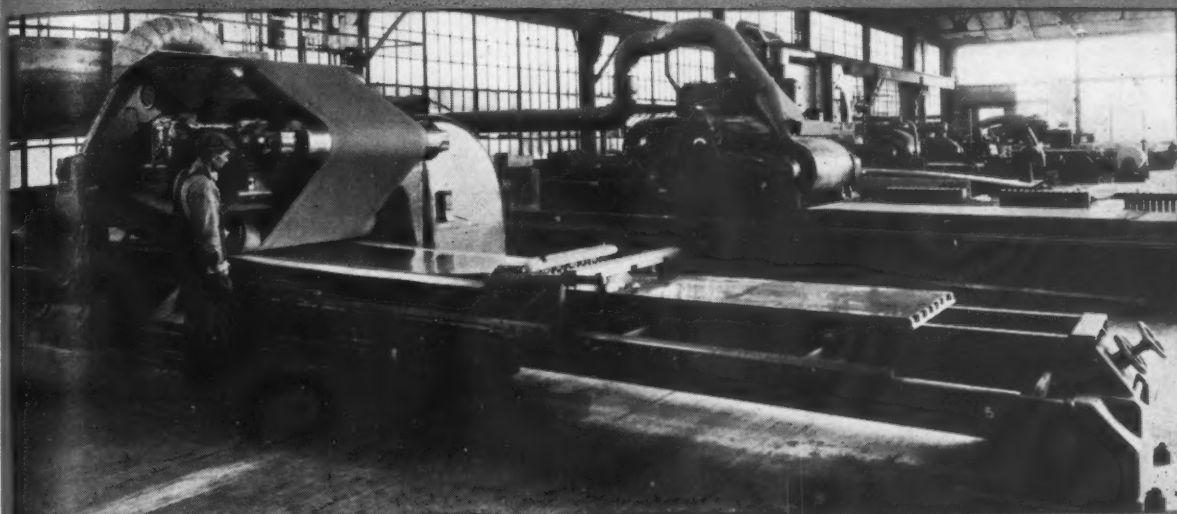
ROCKFORD...FOR ACCURATE, FAST METAL REMOVAL

ILLINOIS, U.S.A.



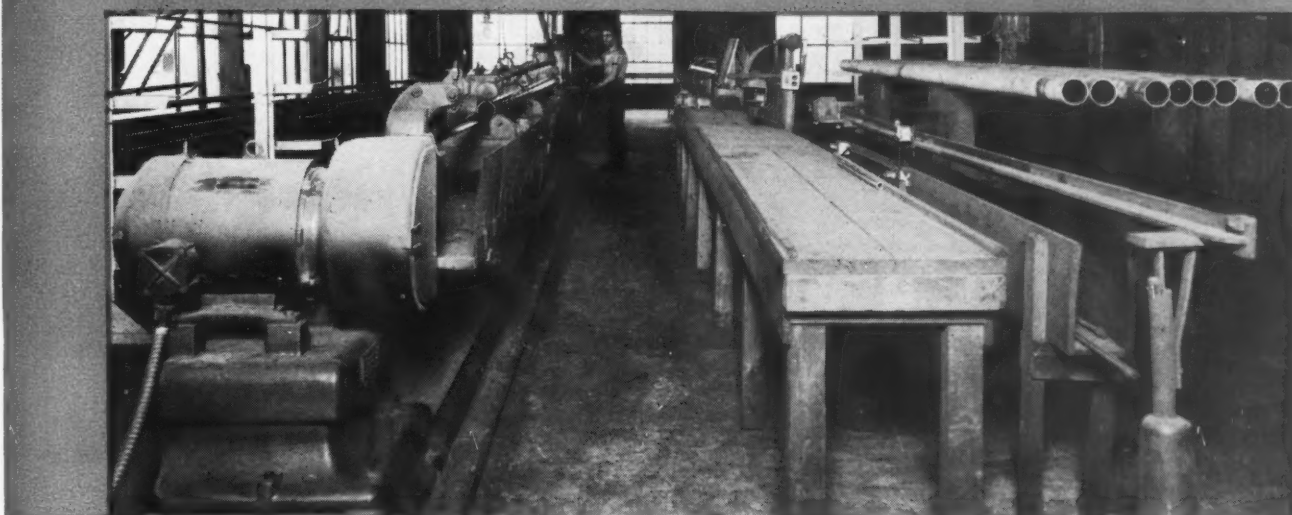
MATTISON WIDE BELT GRINDING AND POLISHING MACHINE...

Designed for proper application of Factory-Coated Abrasive Belts to the grinding and polishing of Stainless Steel and Alloy Sheets.



MATTISON INTERNAL TUBE GRINDING AND POLISHING MACHINE...

for finishing the inside of metal tubes through the use of Factory-Coated Abrasive Belts.



From the time factory coated abrasive belts were introduced for metal polishing and grinding, Mattison's have developed and built machines properly applying belts to the job to be done. If your polishing work includes wide sheets or the inside of tubes you will be interested in the capabilities of the two machines shown above.



Separate Circulars are available giving complete information on the machines shown. Write for free copies today.

MATTISON

MACHINE WORKS

ROCKFORD • ILLINOIS

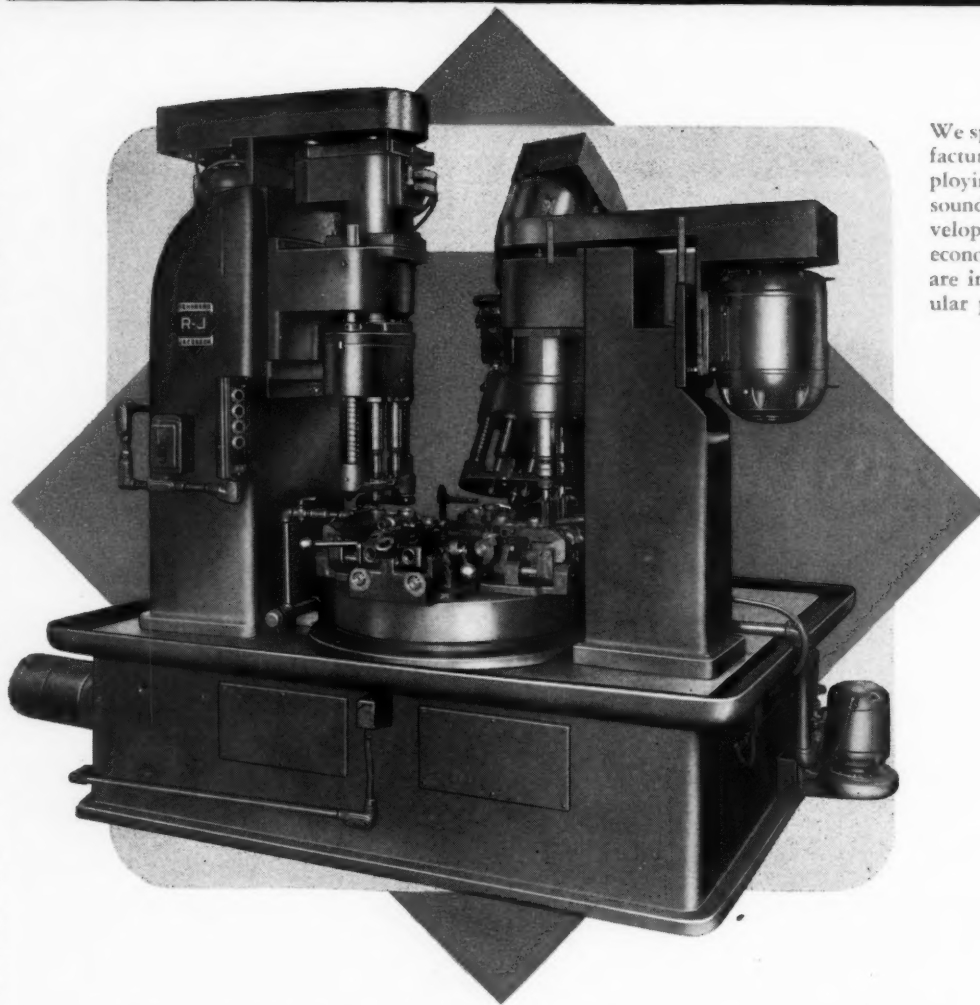


YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...

ROCKFORD

ILLINOIS, U.S.A.

Rehnberg-Jacobson



We specialize in the design and manufacture of production machinery employing ingenious applications of sound mechanical principles to develop equipment distinguished for economy and accuracy. Your inquiries are invited on the solution of particular production problems.

DRILLING AND TAPPING MACHINE USED ON AUTOMOBILE BRAKE MASTER CYLINDER CASTINGS

Two identical pieces are loaded into a special work-holding fixture at the front position. A hand lever on the fixture flips up two side clamping plates carrying pins which register into drilled holes in the castings — a simple, ingenious, and very quick method of securely clamping the work. In the first working position, a 4-spindle head on a Rehnberg No. 45 Drill Unit core drills and counterbores two $\frac{7}{8}$ " x 1.130" welsh plug holes, and core drills, chamfers, and faces two holes for tapping — using combination tools on all spindles. The next unit core drills and counterbores a similar welsh plug hole at an angle in each piece, using a Rehnberg No. 45 Drill Unit and two-spindle head. A special tapping unit in the final position taps the two $1\frac{1}{4}$ "-18 holes. The fixtures are carried on a 4-position 30" R-J Automatic Index Unit. Indicated production is 450 pieces per hour at 100% efficiency.

REHNBERG - JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF
SPECIAL MACHINERY



2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...MACHINE TOOL SHOPPING CENTER
ILLINOIS, U.S.A.

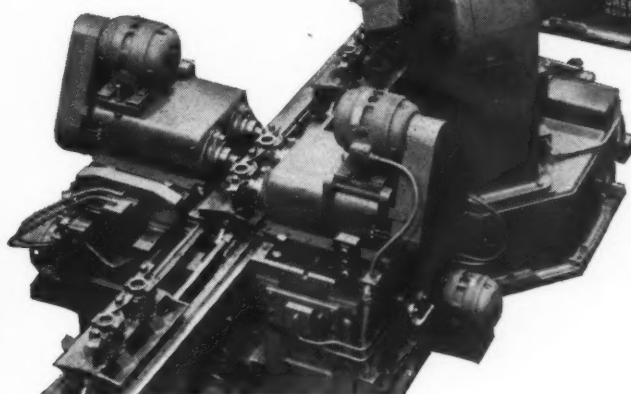
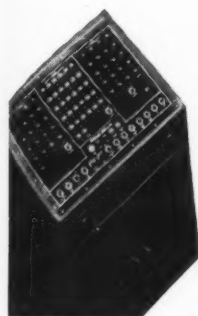


GREENLEE

24-STATION TRANSFER MACHINE

**DOES 31 DIFFERENT OPERATIONS,
DELIVERS 188 PIECES PER HOUR**

The majority of all the many machining operations required on cast-iron Compressor Bodies for a leading line of domestic refrigerators are performed on this 100-foot-long machine. All of the 31 operating units are fully automatic, hydraulically operated, and electrically interlocked. Each station is a twin unit, working on two pieces simultaneously. The machine produces 188 pieces per hour at 80% efficiency. *This is an excellent example of the trend in production-machinery design, to meet the demands for efficiency, speed, and low machining cost where large quantities of identical pieces are required.*



Left, the rough casting with preliminary machining. The skirt is finished, the main center bearing roughed, and two locating dowel holes drilled in the skirt.

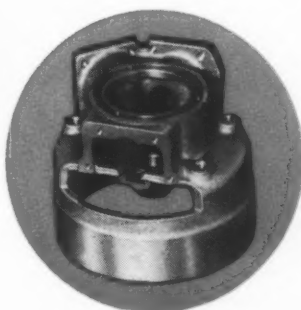
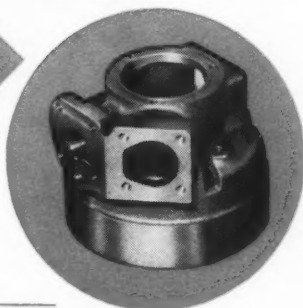
There are 152 separate operations performed on each pair of Compressor Bodies as they go through 19 working stations, 2 inspection stations, 1 loading station, and 2 idle stations. These operations require 50 drills, 12 face mills, 2 side mills, 2 end mills, 12 boring tools, 38 chamfering tools, and 36 taps. There are 39 motors on the machine, totaling 169 horsepower. Eight miles of wire connects 148 limit switches, 78 indicating lights, 107 push buttons, and 226 magnetic starters, contactors, and timers. Not shown in the picture are a power driven return conveyor for the work-holding fixtures, and a power driven chip conveyor running underneath the full length of the machine.

GREENLEE BROS. & CO.

1866 MASON AVENUE, ROCKFORD, ILLINOIS

PRODUCTION MACHINERY

GREENLEE



Left, two views of the piece as it comes off the GREENLEE Machine, showing the variety of work performed from 3 side directions and above. Only two operations — diamond boring the cylinder and main bearing, and grinding or lapping the cylinder head contact face — remain before the piece is completed and ready for assembly.

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

ROCKFORD

MADE IN

ROCKFORD MADE MEANS PRECISION MADE... **ROCKFORD**

ILLINOIS, U.S.A.



STRAIGHTENING PRESS

for Heavy Work

Traveling Ram Rolls Easily
... Accurately Placed by Hand Wheel

With the traveling ram positioned at one end of the table a crane can lower heavy work into place then the ram can be placed, wherever required, over the work.

The ram rolls on four ball bearing equipped wheels and is easily moved into position by means of a hand wheel.

The table is equipped with a "V" slide on which are mounted spring loaded centers and checking rolls. The bed is a welded structure 11 feet long, however, the length can be made to suit a customer's requirements. Length of stroke 6". Longer strokes available to meet individual needs. Power requirements are a 3 h.p. motor.

Send for Bulletin No. 6-6

ANDERSON BROS. MFG. CO.

Anderson

ROCKFORD, ILL. U.S.A.

**Anderson Indicator Takes
 Guesswork Out
 of Straightening**

*It tells the
 Operator*

1. The exact amount of runout.
2. Where to stop the shaft and do straightening.
3. During the pressure operation, it indicates how much shaft is being bent.
4. As soon as pressure is released it shows result of first straightening "try" and gives a guide for the next operation.

MADE IN

ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS

ILLINOIS, U.S.A.

Machinery, June, 1946



*Time Saved...
is Money Saved*

Loading is Fast and Simple on this *American* Broaching Machine

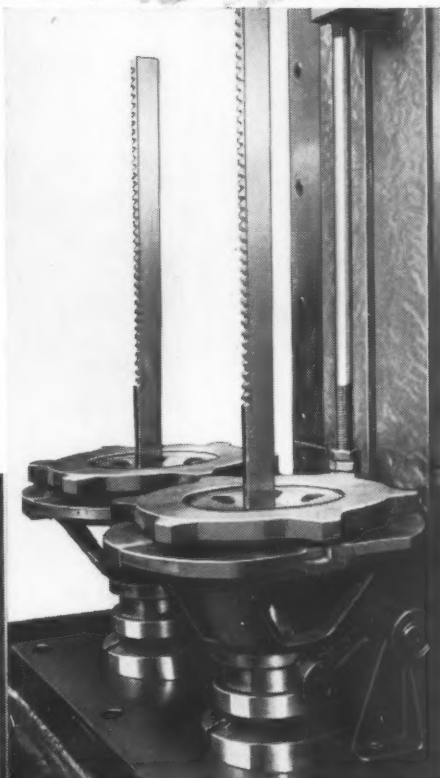
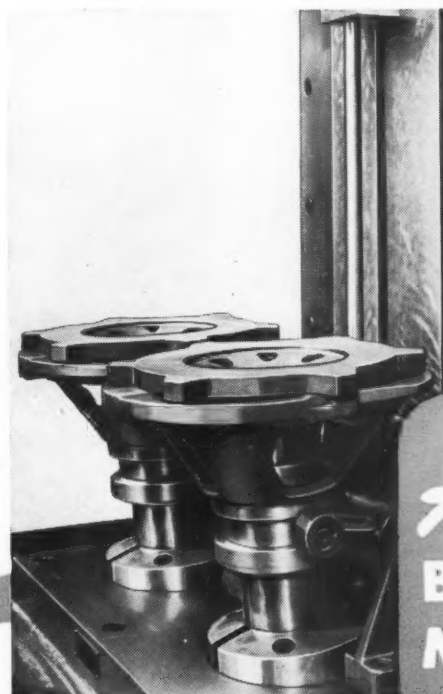


Due to simplified loading and unloading procedures, which permit the broaching of two pieces simultaneously, this *American* T-4-24 Broaching Machine enables you to complete as many as 250 pieces every hour.

In broaching keyways in taper bore automotive clutch driving plates, the fixture lifts the part above the broaching position at the end of the work stroke. This permits the part to be easily removed and the next part loaded at the same point in the machine cycle. The broach, which is connected to the pulling head, is returned with the part loaded in the fixture. Cams operated by movement of the machine slide automatically lower the part to broaching position as the broaching stroke starts.

This is a typical example of the operating efficiency of *American* machines. All make possible fast, accurate output with fine finish. When planning new production, make use of *American's* complete broaching service—machines, tools, and engineering. Write today for details. There is no obligation.

Illustrations show the broaching of keyway in taper bore automotive clutch driving plate on an *American* T-4-24 Broaching Machine. Picture at far right shows fixtures in the "down" position, ready for the broaching stroke. Other illustration shows the two fixtures in raised position for unloading and loading. Actuation of the fixtures is automatic with the machine stroke.



MEMBER
**BROACHING TOOL
INSTITUTE**

American
**BROACH AND
MACHINE CO.**

ANN ARBOR, MICHIGAN
BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY



Protect your
broaching
tools when not in use. Tools last
longer and give more satisfactory
service if this precaution is taken.

ROCKFORD

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S... **ROCKFORD**

ILLINOIS, U.S.A.



Profitable Short-Run MACHINING of Small Parts

13 OPERATIONS PERFORMED SIMULTANEOUSLY ON SPECIAL BARNES SINGLE END MACHINE

This special W. F. and John Barnes Single End Machine is one of five Barnes machines at this plant . . . where metal working operations on gear housings, and other pump components are performed, following an initial milling operation. Inlet and outlet ports and pressure relief holes in gear housings are drilled, reamed, counterbored and tapped on the Barnes Single End Machine. A standard Barnes hydraulic sliding head unit with 7 spindles, drills, reams and counterbores the housing, while the tapping operations are performed by a left hand 2-spindle and a right-hand single spindle tapping unit. A manually indexed 9-station trunnion fixture holds nine housing. As the fixture is indexed, the machining cycle of traverse forward, feed, dwell, traverse return and stop is push-button controlled.

LOW COST MACHINING EFFICIENCY . . . FOR SHORT RUN OR HIGH PRODUCTION JOBS

You effect extraordinary savings in time and manpower with W. F. and John Barnes Special Machine Tools . . . whether you are faced with high production requirements or whether you machine various parts in moderate sized lots. Barnes machine versatility makes them highly adaptable to many types of multiple machining operations. It is possible to combine in ONE machine drilling, reaming, boring, tapping, chamfering, milling, hollow milling and/or facing operations on short run or high production jobs . . . on small or large, simple or complex parts.

Barnes engineers can tell you of the possibilities of securing all-around economy with Barnes Special Machine Tools if you will send us complete details of your jobs — what has to be done, the accuracy required, and the rate of production desired. There is no cost or obligation for this service.

Do You Have This
"PRODUCTION IDEAS" BOOK?

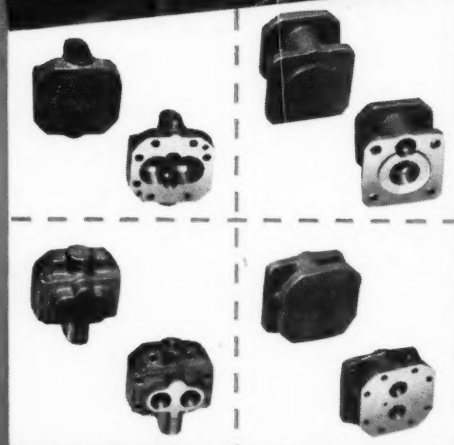


The Barnes "Special Machine Tools" Book should be in your files . . . for it has many valuable metal working production and tooling ideas and suggestions on a wide variety of products. Key production men can get their FREE copy by writing on company letterhead for Book No. 646.



W. F. and JOHN BARNES

320 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.



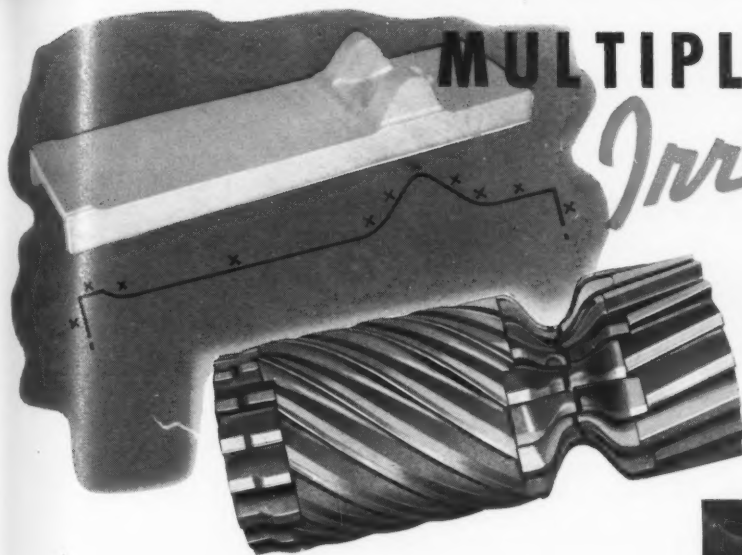
TOOLING and OPERATIONS

Number of Spindles — 9.
Operations Performed:
Barnes SH-75 Hydraulic Sliding Head Unit (7 spindles)
Station 1—Drill $1/4"$ hole, $2-3/32"$ deep
(pressure relief hole)
Station 2—Drill $11/32"$ for $3/8"$ reamed hole to depth
Station 3—Ream $.365$ $3/8"$ diameter reamed hole
Station 4—Ream $.370$ and $.325$ diameters and chamfer
 45° , and form $3/8"$ radius in $1/4"$ drilled hole
Station 5—Counterbore $41/64"$ diameter, $1/32"$ deep;
and ream $29/64"$, $9/16"$ deep
Station 6—Drill $7/16"$ diameter through cored gear
pocket
Station 7—Drill $7/16"$ diameter through opposite side
Left Hand Tapping Unit (2 spindles)
Station 8— $1/2"$ — 20 Standard, $1/2"$ deep tap
Station 9— $1/4"$ straight pipe tap
Right Hand Tapping Unit (1 spindle)
Station 9— $1/4"$ straight pipe tap
(Parts are located on finished surface and two $.1875$
reamed holes.)

MADE IN

ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT





MULTIPLE

*Irregular Shaped
Surfaces*

**COMPLETELY MILLED
in
ONE SET-UP**

Gang of Six B-C Profile Formed Cutters Produce 33 Pieces per Hour

One solution for faster milling production is to combine operations. Here is an example of how Barber-Colman Cutter Engineers accomplished this by designing a gang of cutters to mill stepped, plane and curved surfaces all in one set-up.

Because the material was tough, and because excellent finish was required with the piece sized to length, a second cut was recommended for finishing. A pair of half side mills was added to the original gang, one at each end, for this operation. Result, 33 complete pieces finished per hour.

B-C CUTTER SERVICE FOR METAL WORKING PROBLEMS

This Milling Cutter Service can also work for you with the same outstanding results. Production, fine finish, and accuracy will be obtained, all with reduced tool costs. Our engineers are available to work with you right in your own plant if you desire. Try this service today. Ask a Barber-Colman Field Engineer to quote on your Milling Cutter requirements.



Cutter Performance Facts

Material — Arma steel casting, grade "B", 163-207 Brinell

Operations — Rough and finish mill top and side surfaces

Machine — Milwaukee Milling Machine

Feed — 3-1/2" per minute rough milling; 3.67" per minute finish milling

Cutter Speed — 96 surface feet per minute for both operations

Cutting Time — 33 per hour

Cutter Life—1000 pieces per sharpening

Rough Stock Removed—1/16" x 2-3/4" x 11.292"

Finish Stock Removed—.012" x 2-3/4" x 11.292"

HERE'S A VALUABLE FIELD SERVICE

Send in a blueprint with complete job information of one of your milling problems. Include tolerances required, material condition and specifications, name and model of milling machine used — show horsepower rating, number of pieces to be produced, and finish required. We will send you without any obligation complete information on the proper cutter design and specifications, feeds and speeds recommended, and the proper sharpening clearances.

HOBBING MACHINES,
HOBS, HOB SHARPENING
MACHINES, REAMERS,
REAMER SHARPENING
MACHINES, MILLING CUT-
TERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

GENERAL OFFICES AND PLANT • 109 LOOMIS ST. • ROCKFORD, ILL., U.S.A.



FOR METAL REMOVAL WITH ACCURACY AND SPEED...

ROCKFORD

ILLINOIS, U.S.A.

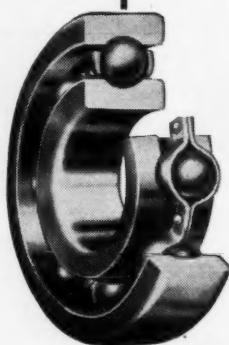
CHECK THESE 4 ANSWERS BEFORE YOU SPECIFY BALL BEARINGS

Although ball bearings represent a small part of machine and equipment cost, they should be selected with care. To specify bearings without considering *at least* the four questions listed below is to risk faulty performance or breakdown.

QUESTION

ANSWER WITH BCA'S

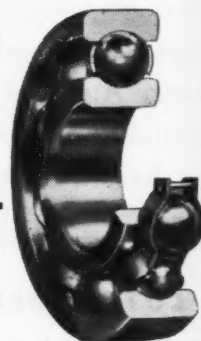
- 1 Is the bearing of the correct type for the job?



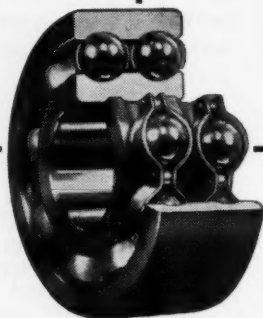
BCA will gladly study your service conditions and advise you about the bearing best suited to your requirements—wherever you use radial, thrust or angular contact ball bearings.

- 2 Does the bearing incorporate modern design advantages?

Each type of BCA Ball Bearing incorporates the important features of modern design. Both the leakproof seal and the pre-lubricated clutch bearing were pioneered by BCA.



- 3 Has the bearing been engineered with ample safety margins?



BCA Ball Bearings are engineered with ample margins of safety for all specified shocks, loads and thrusts.

- 4 Are engineering data and maintenance instructions available?

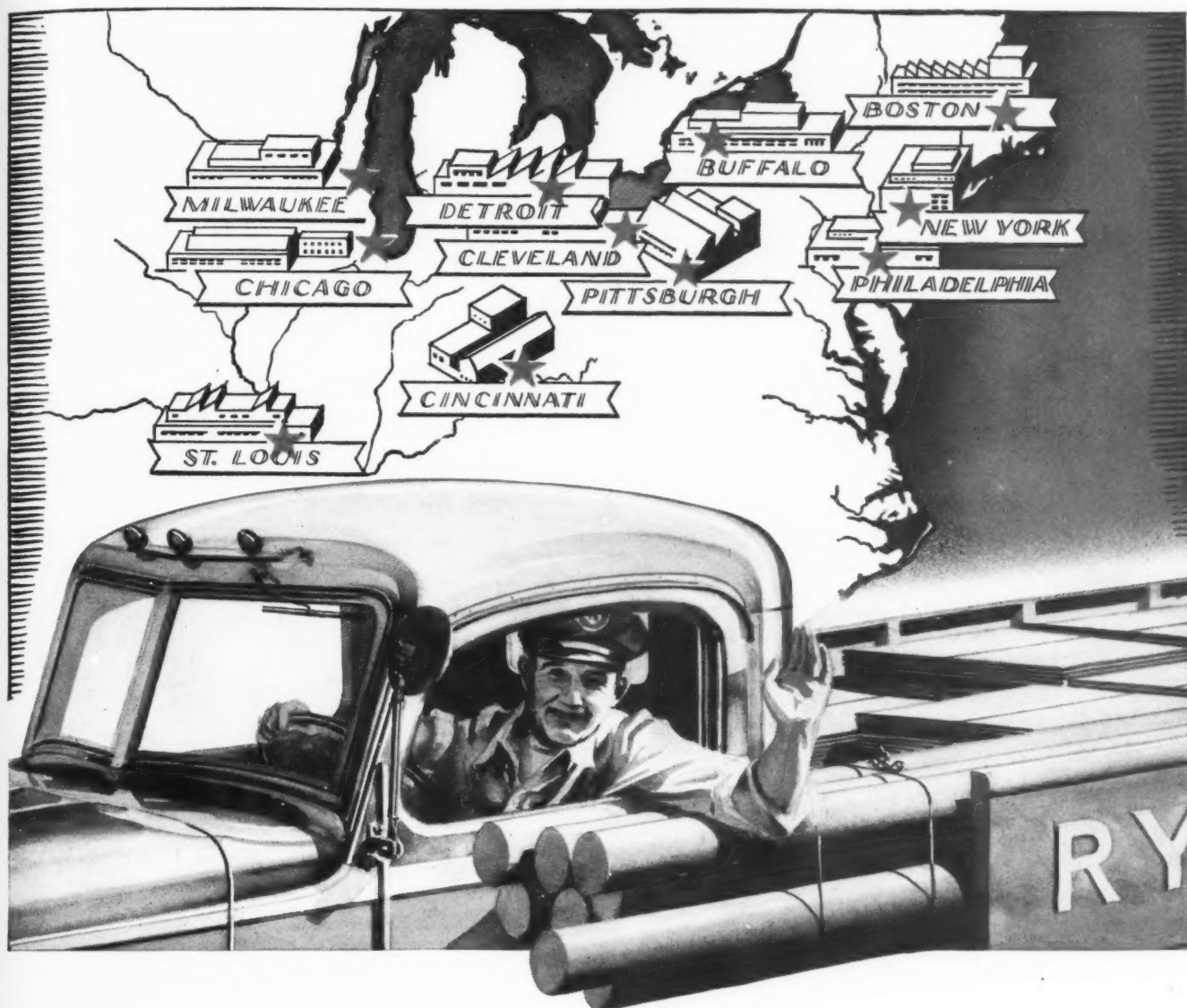
Full engineering data and maintenance instructions are given in the BCA catalog. Send for free copy.

BEARINGS COMPANY OF AMERICA • LANCASTER, PENNA.

BCA

BCA

RADIAL • ANGULAR CONTACT • THRUST
BALL BEARINGS



NEXT-DOOR service on steel

Quick delivery to your plant or job

ELEVEN Ryerson Steel-Service Plants provide unmatched facilities virtually next door to every steel user in the principal markets of the United States. Though many sizes are missing because of the steel shortage, each plant has large, diversified stocks. Each is backed up by the inventories and facilities of the others. These strategically-located steel stocks plus modern high speed equipment are your assurance that orders will be filled accurately and promptly.

Ryerson metallurgists and engineers provide reliable help in solving problems of selection and fabrication. Questions of heat treatment are answered by the hardenability report sent with each Ryerson alloy shipment.

Complete, trouble-saving service on steel from

stock is available to you at every plant in the Ryerson network. When you need steel of any kind call Ryerson.

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, St. Louis, Detroit, Cincinnati, Cleveland, Buffalo, Pittsburgh, Philadelphia, New York, Boston.

PRINCIPAL PRODUCTS

Carbon and Alloy Steels, Allegheny Stainless, Tool Steel, Bars, Plates, Sheets, Structurals, Mechanical Tubing, Inland 4-Way Floor Plate, Reinforcing Bars and Accessories, Boiler Tubes, Welding Rod, Babbitt, Bolts, Rivets, Metal Working Tools & Machinery, etc.

RYERSON STEEL

There is
**ONE
RIGHT
SOURCE**

for **Sleeve Type Bearings**

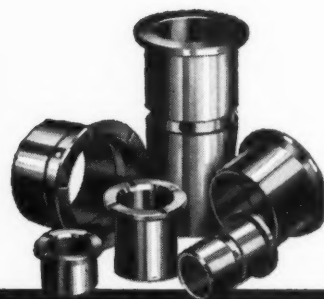
There are several reasons why many leading manufacturers regard Johnson Bronze as the RIGHT source for all their Sleeve Bearings. For instance, we are the only bearing manufacturer that produces ALL types of Sleeve Bearings. This enables us to help the purchaser select the correct bearing for each application. It permits us to give sound bearing advice . . . based on facts . . . without prejudice for any one type. Every bearing we produce is manufactured complete in our plant . . . from molten metal to finished product. Thus we have constant control over every step in the process. We manufacture only one type of product . . . Sleeve Bearings. All of our facilities, our resources and research has but one objective . . . to give our customers better bearings at lower cost. Isn't this the type of bearing service you have been looking for? Your inquiry carries no obligation . . . why not write TODAY?

JOHNSON BRONZE CO.

520 S. MILL STREET • NEW CASTLE, PA.

JOHNSON
SLEEVE BEARING HEADQUARTERS
BRONZE

The modern plant of Johnson Bronze. Over four acres devoted exclusively to the complete manufacture of Sleeve Type Bearings.



FOR SALES APPEAL THAT'S BASED ON ADDED VALUE

-nothing equals Stainless Steel!

SHINING golf clubs that make even a "pro's" eyes sparkle — rust-proof eggbeaters that sell on sight — gleaming pots and pans that delight a housewife's heart — lightweight streamliners that are sold out months in advance — long lasting industrial equipment of every kind that manufacturers are proud to call their own. They *all* attest to the superlative selling power of Stainless Steel.

For Stainless does more than add eye-catching beauty. It adds strength, toughness and stamina. It adds high resistance to heat, wear and abrasion. It insures practical immunity to corrosion, stain and tarnish. It means easy cleaning . . . long life under hard usage . . . goodness that cannot wear off. No wonder Stainless Steel today, stands at the very top in popular preference.

The permanent good looks, greater endurance and superior mechanical

performance that can be obtained with Stainless, you can build into your product at low cost by the *proper* use of the right grade of U·S·S Stainless Steel.

A service-tested, perfected steel, U·S·S Stainless will meet practically any application and fabricating requirement. It is available not only in many different analyses but is produced in the *most complete* range of

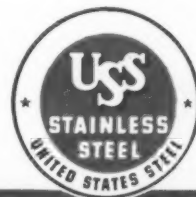
forms, sizes and finishes obtainable anywhere.

Our engineers are specialists in the solving of new and unusual problems in the use of Stainless. Their practical assistance is backed by the laboratory and research facilities of the world's largest producers of fine steel. Both are at your service to help you use U·S·S Stainless to the best economic advantage.

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago and New York
CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago
COLUMBIA STEEL COMPANY, San Francisco
NATIONAL TUBE COMPANY, Pittsburgh
TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham
United States Steel Supply Company, Chicago, Warehouse Distributors
United States Steel Export Company, New York



UNITED STATES STEEL

Simplify

WITH BETHLEHEM'S BIG 8 TOOL STEELS

The BIG 8 Family

Carbon Tool Steel
(water-hardening)

Tool Room (BTR)
(oil-hardening)

Omega
(maximum shock-resistance,
cold work)

No. 67 Chisel
(high shock-resistance,
both hot and cold work)

Air-Hardening
(low distortion during
heat-treatment)

Lehigh Die & Tool, H Temper
(high-production die steel)

No. 57 Hot Work
(maximum red-hardness in hot work)

No. 66 High Speed
(general-purpose high-speed steel)

Because the Big 8 will do some 90 per cent of your tool-steel jobs—and do them superlatively well.

Because it is easy to learn their properties, their applications, their personalities.

Because there isn't a "fussy" steel in the group.

It all boils down to this:

The average toolroom no longer needs to maintain a wide and confusing assortment of one-purpose steels. Not with Bethlehem's Big 8 in stock. The Big 8 group is small, compact . . . easy to heat-treat, easy to handle . . . and amazingly versatile.

Use these steels to the fullest advantage. Be sure you acquaint yourself with *all* their uses. That's your opening step in a program of simplified toolroom practice. Write for your Big 8 Kit—a set of booklets on these versatile tool steels.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



★ ★ ★

★ ★ ★

**You get better, more tenacious adhesion
of Organic Finishes on ALUMINUM when
surfaces are conditioned with**

Oakite Compound No. 36

Products fabricated from aluminum and its alloys and to which organic finishes are applied for decorative or protective purposes, require special surface treatment if firm, tenacious grippage of paint, enamel or lacquer is desired. Rejects and poor quality work frequently result when proper surface preparation is omitted.

There are many methods for handling this work. A few are more effective and economi-

cal than others. One of these is the Oakite method involving a simple chemical treatment with Oakite Compound No. 36. A mildly acidic liquid material, Oakite Compound No. 36 microscopically etches surfaces and then forms a thin, inert, adherent film of aluminum phosphate, which not only retards corrosion but, at the same time, provides a surface and base for the tenacious grippage of organic finishes.

Three Ways to Apply

Oakite Compound No. 36

After pre-cleaning Oakite Compound No. 36 may be applied by automatic washing machine, dip tank method or by hand wiping technique. Method depends on size and shape of aluminum parts; production volume and equipment available.

Free Data Gives

You Method Details

Any plant applying paint finishes to aluminum should send for free Special Service Report giving details of this plant-proved Oakite method for successfully conditioning aluminum. Please make request on your company letterhead. All inquiries promptly answered.



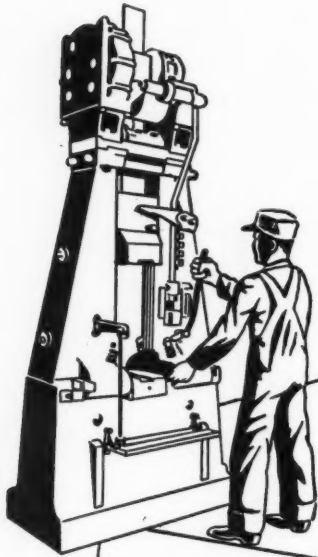
Oakite Products, Inc., 24 Thames Street, New York 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

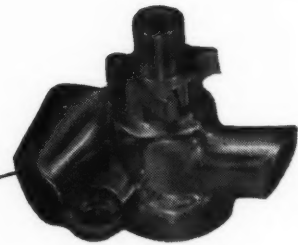
OAKITE *Specialized* **CLEANING**

MATERIALS • METHODS • SERVICE

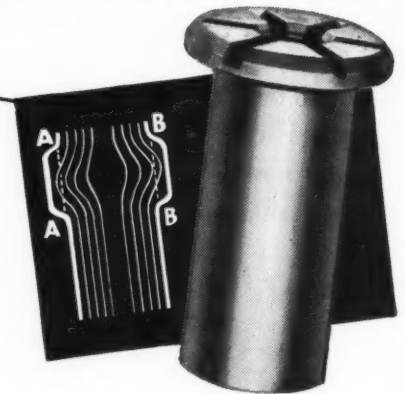
YOU GET CORROSION RESISTANCE PLUS



LONGER LIFE. In spite of tremendous pressures and highly abrasive conditions in service—forged knuckle pins like this stay on the job longer because they are made from Carpenter Stainless. And note in the diagram that forging produced an even grain flow throughout, thus strengthening the thin sections at points AA and BB.



LOWER UNIT COSTS. This aircraft fuel supply valve body was forged from Carpenter Stainless No. 8 (Type 303) forging bars. Our *machine-turned* billets, from which all Carpenter forging bars are rolled, provided freedom from injurious surface defects, reducing rejects to a minimum. The corrosion resistant properties of Stainless No. 8 licked the danger of "valve sticking" from high octane gas.



POSITIVE PROTECTION against corrosion to withstand the effects of repeated sterilization plus the required strength and hardness, made Stainless a natural choice for these forged surgical instruments. Clean, flawless Carpenter Stainless forging bars reduced rejects, increased output.



ECONOMICAL, TROUBLE-FREE FORGINGS WITH *Carpenter* STAINLESS

If rejects run high when forging Stainless, it's time to check all along the line. Many factors must be controlled right in the forge shop. But to eliminate trouble and secure best results you must be sure that your forging bars are sound, clean and free from injurious surface defects. Such forging bars assure easiest forging operations and lowest production costs.

At Carpenter, Stainless Steels are made in a tool steel mill to tool steel quality standards. Stainless billets are inspected to assure soundness and homogeneity—and are then *machine-turned* to remove all surface imperfections. By this painstaking process we end up with Stainless bars that, lot after lot, assure economical, trouble-free forgings.

You'll find your nearby Carpenter representative extremely helpful when it comes to finding ways and means of applying Stainless to your postwar products. Back of him stands a company with years of practical experience in solving Stainless problems. Call him in today or write us at the mill.



PUT THIS BOOK TO WORK! In addition to specific Stainless forging information, our 98-page book "Working Data for Carpenter Stainless Steels" shows you how to select and fabricate a wide variety of Stainless Steels. Be sure to get your copy! A note on your company letterhead, indicating your title is all that's necessary. Write today!

THE CARPENTER STEEL COMPANY • 105 W. Bern St., Reading, Pa.

**GIVE YOUR PRODUCTS
THESE EXTRA ADVANTAGES**
... With Carpenter Stainless

- Strength and Rigidity
- Heat Resistance
- Weight Saving
- Freedom from Rust
- No Plating to Peel
- Ease of Assembly
- Longer Product Life
- Sales Appeal

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cincinnati, Cleveland, Detroit, Hartford, Indianapolis, New York, Philadelphia, Providence, St. Louis

TALIDE-tipped Blades Outwear Others *25 to 1*

Talide Blades for centerless grinding have many natural advantages over cast iron, tool steel, and hard faced blades.

Tungsten Carbide has the greatest compressive strength of any known material. Talide Blades wear and wear. You can buy Talide Centerless Blades with the Talide Metal insert of any length in one solid piece. There are no sections or seams to scratch or mar the work. Scoring and galling cause no trouble.

This extra long service life gives you extremely high continuous production rates. Rejects practically disappear from your work sheet.

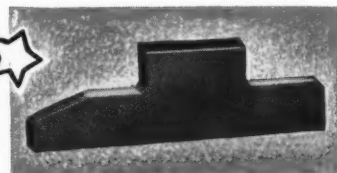
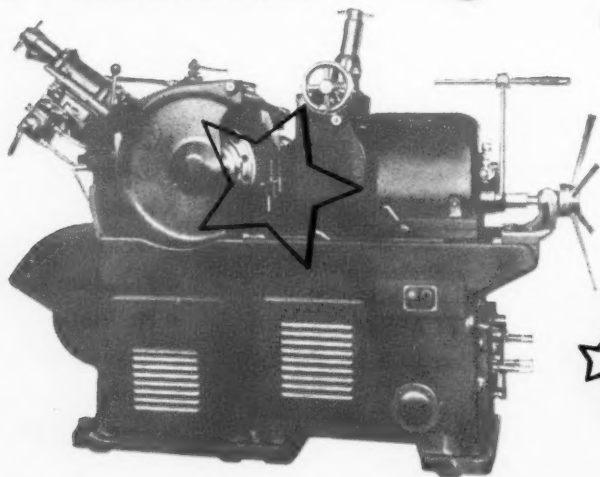
In precision grinding, all types of products...roller bearings, fountain pens, cap screws, twist drills, bushings, shafts, spindles, screw machine parts, Talide Blades always outperform other blades at least 25 to 1.

Metal Carbides Corporation, a pioneer in Tungsten Carbide, will assist you in designing super-hard Talide Blades for your work. Apply this 25 to 1 advantage to your production and watch those costs go down.

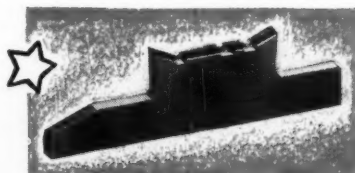
Send for Talide Blade catalog 43-W P, complete with prices, sizes, and specifications.

Standard Blades carried in stock

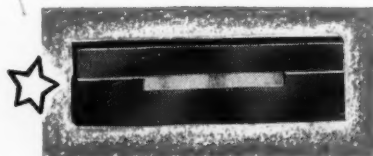
TALIDE METAL MEETS EVERY REQUIREMENT



• IN-FEED •



• FORM •



• THRU-FEED •



Metal Carbides is the only company which can make Tungsten Carbide wear strips in one solid piece of any length

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS



METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

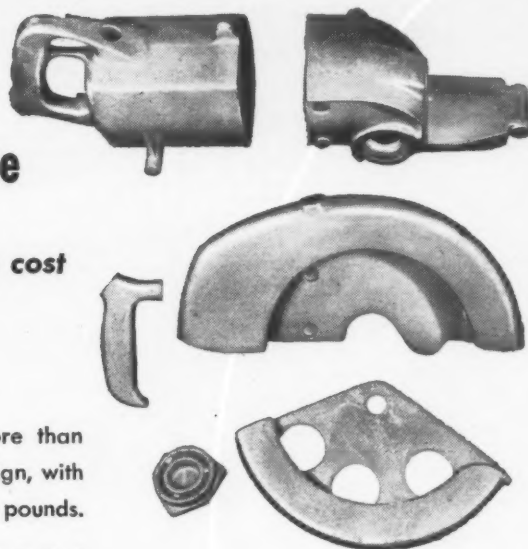
Where lightness cuts . . . fatigue

cuts time . . . cuts labor . . . cuts cost

Here's a sturdy portable power saw built to cut more than lumber! It's cutting expenses on many a job. Skillful design, with *lightweight magnesium*, has held its weight down to 36 pounds.

This product is regarded by its manufacturer, The Mall Tool Company, as the most powerful saw of its type for making heavy cuts. Its combination of lightness and strength owes a great deal to the durable magnesium castings that form the motor housing and back handle, weighing only 2½ lbs.; gear housing, 3½ lbs.; upper guard, 2 lbs.; lower guard, 1 lb.; front handle, ¼ lb.; and bearing cap, ⅓ lb.

It's one of many fine new products making use of magnesium. For further information, contact the nearest Dow office.



MAGNESIUM

LIGHTEST OF ALL STRUCTURAL METALS

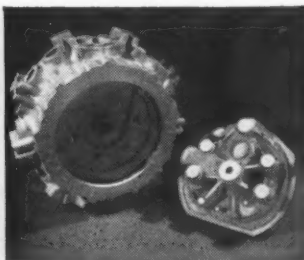
to make products move!



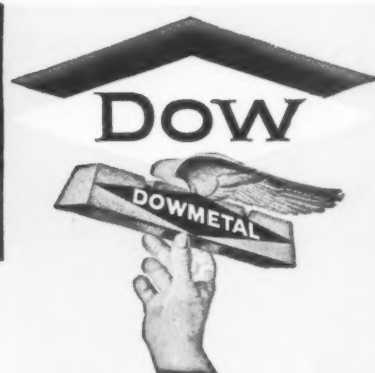
Produced by Dow in ample quantities, magnesium metal is now freely available in all common forms for widespread use.



Many modern plants throughout the country are working with magnesium, following standard procedures and shop techniques.



Magnesium parts of virtually every size and description are being used in a growing variety of fine new products of many kinds.



MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

WHERE CASTINGS NEED

HIGH HARDNESS

Cramp Iron Alloy No. 275 (Ni-Hard) is a nickel-chromium hardened chilled cast iron with a tensile strength of chill of 50,000 to 80,000 p.s.i., and Brinell hardness ranging up to 700.

It is recommended for applications requiring a high hardness for resistance to wear, abrasion, attrition, and deformation; to some extent to high compressive loading; and to a lesser, but important degree, to corrosive action.

The Baldwin Locomotive Works, Cramp Brass & Iron Foundries Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, St. Louis, Washington, Boston, San Francisco, Cleveland, Detroit, Pittsburgh, Houston, Birmingham, Norfolk.

**SPECIFY
CRAMP ALLOY
NO. 275**

RECOMMENDED FOR

SMALL CASTINGS

Grain grinding plates or burrs.

MEDIUM-SIZED CASTINGS

Sand Pumps, etc.

LARGE CASTINGS

Rolls for metal rolling or cement grinding.



Ask for Cramp Bulletin 194 for detailed information on this and other Cramp Alloys.



BALDWIN

CRAMP

FERROUS & NON-FERROUS CASTINGS

In the World's Largest Proving Ground for Mechanical Tubing



... we learned to tailor the tube to the job.

Pictured above is only part of the 600 screw machines in the huge plants of The Timken Roller Bearing Company.

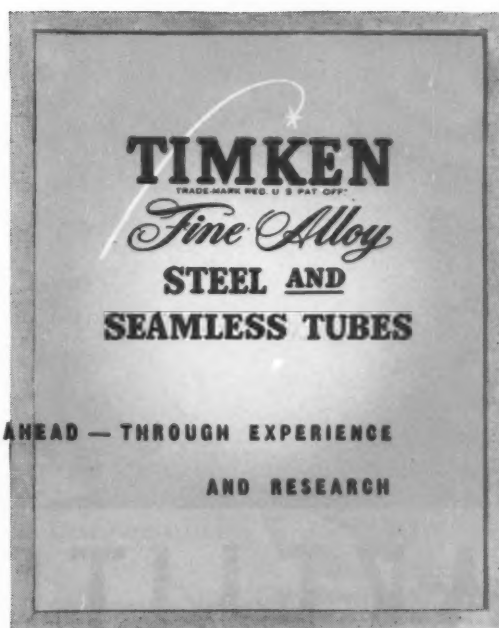
Here, every year, millions of feet of Timken Alloy Steel Seamless Tubing with a wide variety of wall thicknesses is machined to form cones and cups for Timken Roller Bearings in sizes from $1\frac{1}{4}$ inch O.D. to 10 inch O.D.

From this great proving ground and from 30 years experience in supplying alloy steel seamless tubes to major users has developed unequalled experience in producing and selecting mechanical tubing exactly suited in grade, size and finish to meet your exacting requirements in the most economical manner.

Alloy steel seamless tubes very likely will improve your product or lower your cost. Our technical staff is eminently qualified to show you how. Let us send you a copy of our booklet "Timken Seamless Steel Tubes, Finishes and Sizes." Write Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.



* YEARS AHEAD — THROUGH EXPERIENCE
AND RESEARCH



SPECIALISTS in hot rolled and cold finished Alloy Steel Bars for forging and machining applications, as well as a complete range of Stainless, Graphitic and Standard Tool Steel analyses. Also Alloy and Stainless Steel Seamless Tubing for mechanical and pressure tube applications.

SUPER-AIRLINERS DEMAND *PRECISION* IN PLASTIC MOLDED PARTS

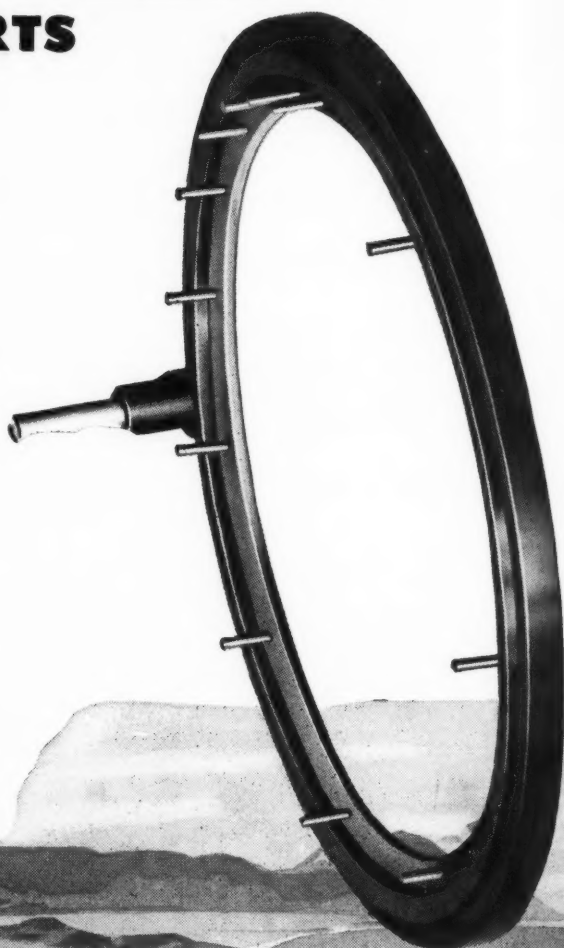
HERE'S a ticklish job and a real accomplishment in plastic molding! But, it's only one example of the supreme moldability of BAKELITE general-purpose phenolic plastics. It is a contact ring for aircraft altimeters* that is molded to tolerances of 0.001 inch in overall dimension and 0.002 inch in thickness. Locating the insert with its gold alloy contact pins is also a critical step.

Molding to close tolerances is achieved by efficient co-operation among designer, plastic molder, mold builder, and plastics material supplier. It enables manufacturers to adopt plastic precision parts with properties scientifically controlled for top service in specific applications.

Electrical resistivity, moisture resistance, dimensional stability, and compact design are the characteristics needed for altimeter contact rings—and BAKELITE general-purpose phenolic plastics bring these qualities in full measure. Yet, precision in plastic molding is not limited to the general-purpose materials. The line of BAKELITE plastics includes materials that are resistant to impact, heat, water, and chemicals, or that excel in dielectric qualities. This great variety permits the choice of the *right* plastic for the specific job.

Bakelite's field representatives and engineering service are always ready to help you apply plastics to your requirements. Write Department 38 for Booklet G-8, "A Simplified Guide to BAKELITE Plastics."

*Precision-molded by Wayne Plastic Products, Fort Wayne, Indiana



BAKELITE PLASTICS

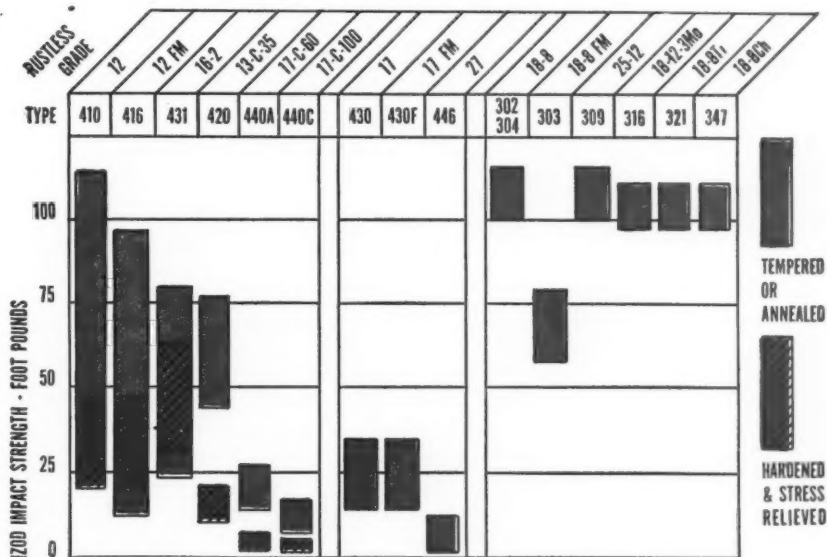
TRADE-MARK

BAKELITE CORPORATION, Unit of Union Carbide and Carbon Corporation  30 EAST 42ND STREET, NEW YORK 17, NEW YORK

RUSTLESS DATA SHEET NO. 4

Corrosion Resistance Plus Toughness

One of the Many Combinations of Properties Offered by Stainless Steels



IZOD impact values, as shown in the above chart for all standard grades of stainless steels, may not represent true mechanical properties directly usable in engineering design, but they are an indication of the great notch toughness offered by stainless steels. The energy in foot-pounds absorbed in breaking the notched test specimen results in stress concentration which is undoubtedly far greater than will occur in any well-designed product in service. However, stress concentrations cannot always be predicted or eliminated and it is often necessary to avoid the safety hazard by using a material which has the capacity to distribute a load at a notch, especially when corrosive attack can cause the "notch." Stainless steels are such materials.

Depending upon the condition, whether hardened or annealed, the martensitic (group on left) show a variation of impact values. The austenitic or chromium-nickel grades (group on right) exhibit extremely high values—higher than any standard engineering alloy. The latter also have the remarkable property of retaining their great toughness at temperatures far below zero. For this reason type 304 stainless steels have been widely used for equipment handling liquid oxygen and nitrogen at hundreds of degrees below zero Fahrenheit. At 100° F. this grade has an Izod impact range of 105-125 foot-pounds. Large quantities have been used in essential working parts of high flying aircraft.

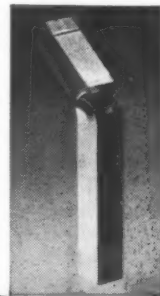
Considering versatility as an important design and fabrication requirement, it can be said that stainless steels offer extreme toughness but still retain adequate workability. Fabricating stainless steels is just different—not difficult. If you need a material to withstand

both corrosion and shock stresses, one of Rustless' stainless steels may be your answer.

As engineering materials, stainless steels offer designers durability, strength, stiffness, economy and sales appeal, in addition to this quality we call toughness. Of course, the proper grade should be selected to meet specific conditions of service and fabrication. That is where Rustless' specialized stainless-steels experience can help. Consult us on your design problems.

This is a notched Izod impact test specimen after it absorbed a force of 82 foot-pounds at room temperature. The grade is Rustless 18-8FM, Type 303 which, incidentally, is machinable at rates exceeding 75% of those used for Bessemer screw stock. It will resist severe corrosion conditions, too. Quite a material!

Valuable Rustless booklets and leaflets are freely available to you, providing technical data, machining methods, how to electro-polish stainless, how to blacken it, etc. Write for complete list of available Rustless publications.



STAINLESS STEEL SPECIALISTS



DIVISION OF



RUSTLESS IRON AND STEEL DIVISION

The American Rolling Mill Company

BALTIMORE 13, MARYLAND

SALES OFFICES AND DISTRIBUTORS IN PRINCIPAL CITIES

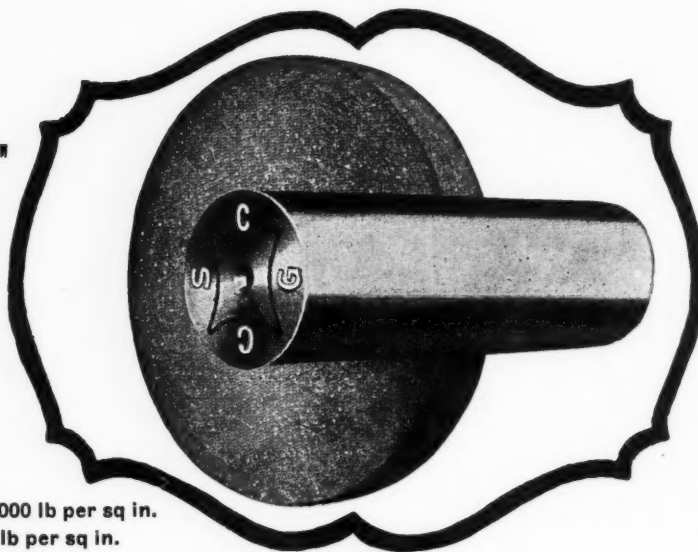
CUMBERLAND GROUND SHAFTS

An Exclusive Product made by an Exclusive Method

**DIAMETERS 1-1/8" to 8"
INCLUSIVE**

**MINIMUM
ELASTIC
LIMIT**

Cumberland Brand—30,000 lb per sq in.
Potomac Brand—45,000 lb per sq in.
Cumsco Brand—55,000 lb per sq in.



**CONCENTRIC
STRAIGHT
ACCURATE**

**MAXIMUM
LENGTHS
MANUFACTURED**
Year 1845—up to 16 feet
Year 1886—up to 25 feet
Year 1945—up to 70 feet

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired.

IMMEDIATE SHAFTS

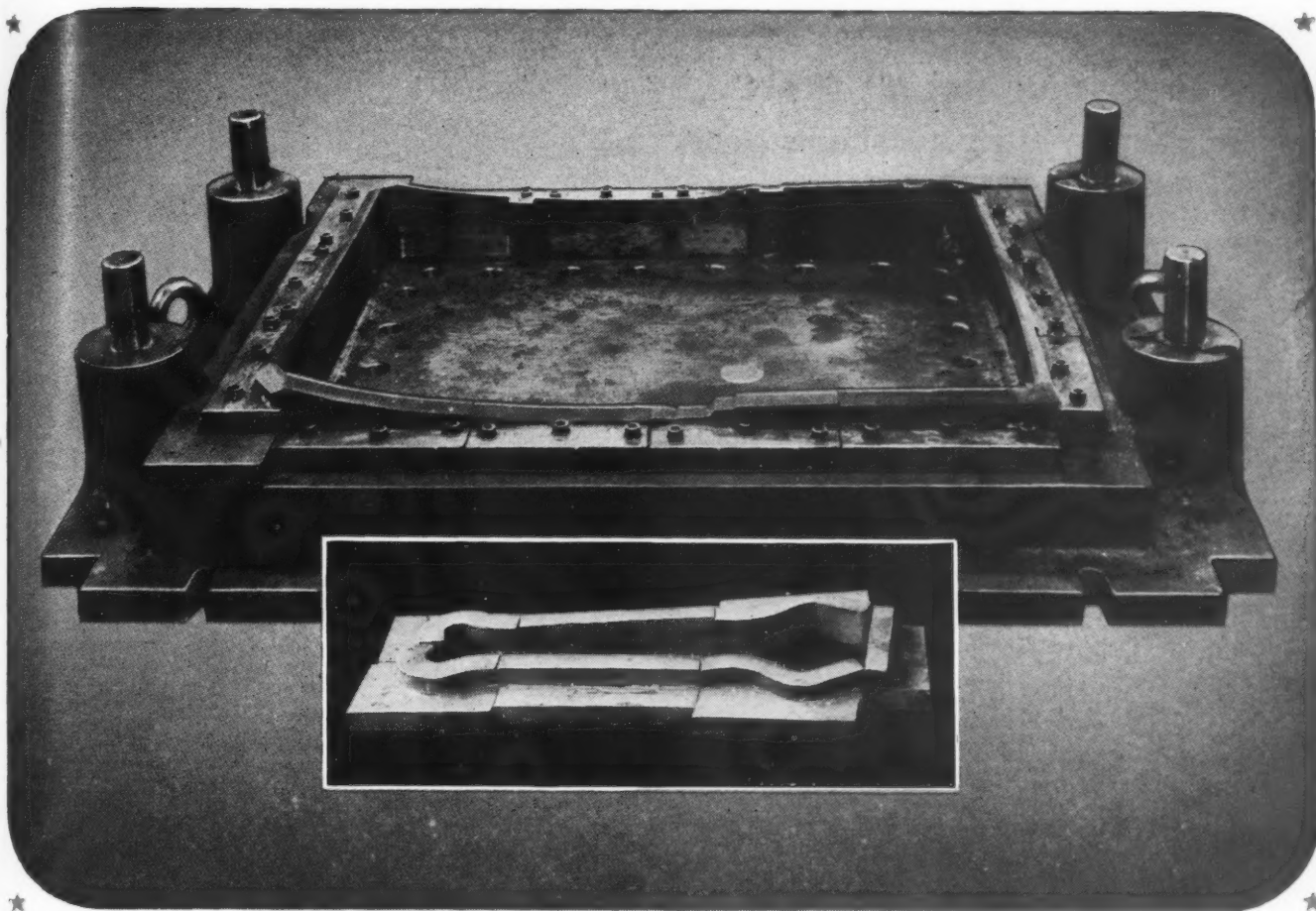
Distributed by

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkrige Brothers Company
Boston, Mass.—Brown-Wales Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, New York—Jos. T. Ryerson & Son, Inc.
Chicago, Ill.—Central Steel & Wire Co.
Cincinnati, Ohio—Jos. T. Ryerson & Son, Inc.
Cleveland, Ohio—The Bissett Steel Company
Dayton, Ohio—Central Steel & Wire Co.
Detroit, Michigan—Central Steel & Wire Co.
Fort Worth, Texas—C. A. Fischer
Hartford, Conn.—Hunter & Havens, Inc.
Indianapolis, Ind.—Tanner & Company
Jersey City, N. J.—Jos. T. Ryerson & Son, Inc.
Kansas City, Mo.—F. H. Turner
Lakeland, Fla.—Mine & Mill Supply Co.
Los Angeles, Calif.—Link-Belt Co., Pacific Div.

Louisville, Ky.—Neill-LaVie Supply Co.
Martinsburg, W. Va.—W. H. Heiston & Son
Montreal, Can.—Drummond, McCall & Co., Ltd.
New York City, N. Y.—Bright Steel Corp.
Oakland, Calif.—Link-Belt Co., Pacific Div.
Philadelphia, Pa.—Charles Bond Company
Philadelphia, Pa.—Horace T. Potts Co.
Pittsburgh, Pa.—McKee-Oliver, Inc.
Portland, Maine—W. L. Blake & Company
Portland, Oregon—Link-Belt Co., Pacific Div.
Providence, R. I.—Congdon & Carpenter Co.
Quebec, Canada—H. Duchene
San Francisco, Calif.—Link-Belt Co., Pacific Div.
Seattle, Wash.—Link-Belt Co., Pacific Div.
Spokane, Wash.—Link-Belt Co., Pacific Div.
Toronto, Canada—Drummond, McCall & Co., Ltd.
Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892



When time is precious —
SPEED YOUR DIE MAKING

SAVE MONEY TOO

**WRITE FOR
 ENGINEERING
 DATA FOLDER**

It contains a blue-print showing thirty-five standard sections available for quick shipment, from combinations of which thousands of die shapes can be made. It also contains prices, weight tables and shows rib-reinforced extra high sections with full instructions for ordering. Get your copy. Write for it today.

Address Dept. M-42

FCC Composite Die Sections are quickly available to your order. Shipment to your specifications can usually be made in five to ten days.

On large dies or small for blanking, beading or trimming, these prefabricated die parts save steel, and a vast amount of time and trouble in the die shop.

They are made of fine tool steel cutting edges in a selection of grades, electrically butt welded by a special process to non-hardenable mild steel bases. Accurate temperature control assures uniformity of behavior in heat treatment.

Further information is available from any Allegheny Ludlum field representative, or write us direct for engineering data (see details at left).



**ALLEGHENY
 LUDLUM**

STEEL CORPORATION
Forging and Casting Division
 Detroit 20, Michigan

You can now obtain parts of simple or intricate shape cast from HAYNES Alloys

HAYNES
TRADE-MARK
**PRECISION
CASTINGS**
☆

FOR HIGH STRENGTH,
HARDNESS, AND
RESISTANCE TO WEAR,
HEAT, AND CORROSION

This new booklet will tell you all about it

This new 20 - page booklet describes the HAYNES precision casting process, and contains photographs and drawings of parts produced by this method. Mail your request to Haynes Stellite Company, Department L, Kokomo, Indiana.

HAYNES
TRADE-MARK

alloys

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation



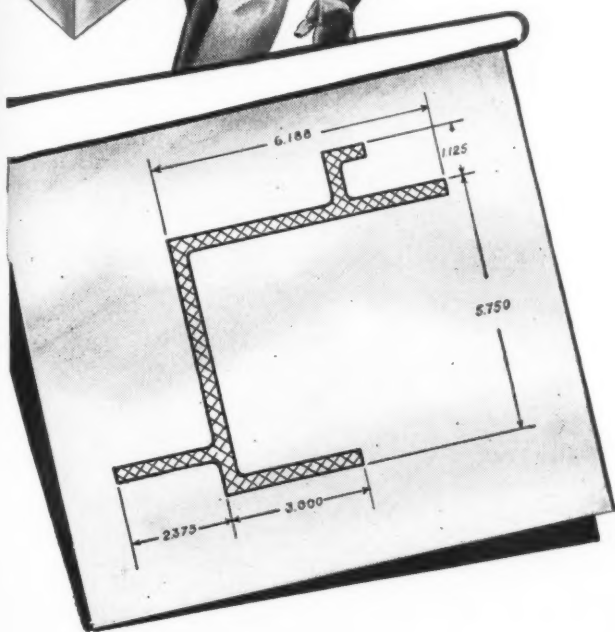
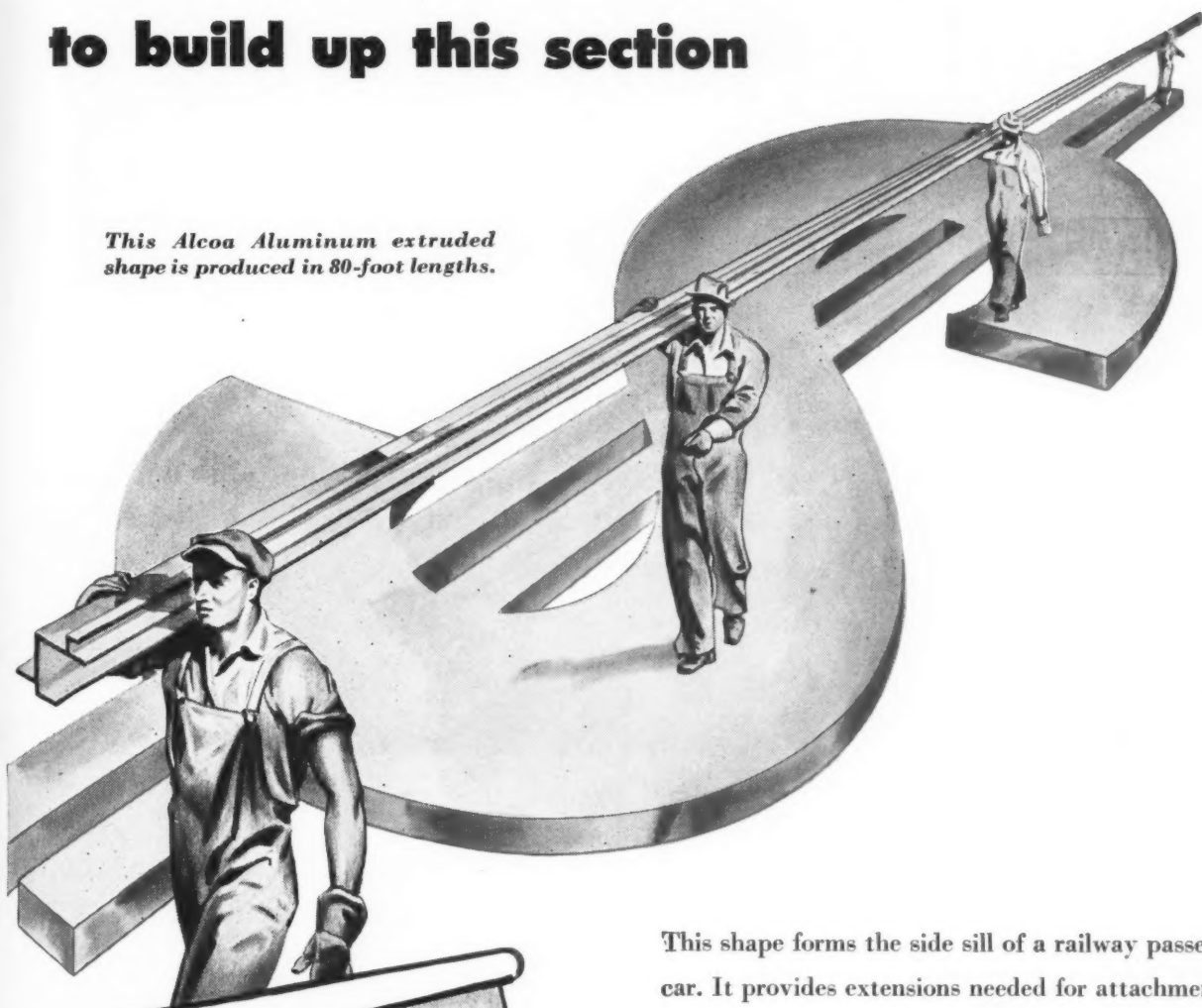
General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—
New York—San Francisco—Tulsa

The registered trade-mark "Haynes" distinguishes products of Haynes Stellite Company.

Figure what it would cost you to build up this section

This Alcoa Aluminum extruded shape is produced in 80-foot lengths.



This shape forms the side sill of a railway passenger car. It provides extensions needed for attachment of every part. It is strong and dependable, yet doesn't contain a single pound of *needless* weight.

To build up this section, you'd probably rivet together channels, angles, and Z's. You'd have excess metal where one section overlapped another. You'd have the added weight of rivets. You'd pay for many hours of labor to assemble it. As one Alcoa customer put it, "We can't afford *not* to use extruded shapes."

For help on figuring how you can use Alcoa Aluminum extruded shapes to best advantage, call the near-by Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 1748 Gulf Building, Pittsburgh 19, Pa.

ALCOA FIRST IN ALUMINUM



Need specialty steel fast?

Crucible's full range of specialty steels

HIGH SPEED • MACHINERY • TOOL • ALLOY • STAINLESS • SPECIAL PURPOSE

all obtainable promptly from

Crucible's Warehouse and Distributor Network

To have a full range of Specialty Steels readily available in your own locality is but one advantage brought you by Crucible's distribution set-up. Also available are the services of trained, practical steel men who will cooperate with you in the selection and application of the best steels for each production purpose.

ALABAMA

Birmingham
Young and Vann Supply Company

ARIZONA

Douglas
Phelps Dodge Mercantile Company
Kingman
Tarr, McComb and Ware Company
Phoenix
Allison Steel Manufacturing Company

CALIFORNIA

Fresno
Federal Pipe and Supply Company
Fresno Agricultural Works
Kyle and Company
Grass Valley
Alpha Stores, Ltd.

Los Angeles

A. M. Castle Company
★ Crucible Steel Company of America
Garrett Supply Company
Pacific Metals Company
Union Hardware Company

Nevada City

Alpha Stores, Ltd.

Oakland

A. M. Castle and Company
Earle M. Jorgensen Company
C. W. Marwedel

San Francisco

Anderson Steel Products
A. M. Castle and Company
★ Crucible Steel Company of America
Federal Pipe and Supply Company
C. W. Marwedel
Northern California Hardware & Steel Co.
Pacific Metals Company
Scheid Heavy Hardware & Steel Co.
Taylor and Spotswood Company

San Jose

San Jose Hardware Company

Sonora

Tuolumne Foundry & Machine Works

Stockton

Hickinbotham Brothers
H. C. Shaw Company
Kyle and Company

COLORADO

Denver

★ Crucible Steel Company of America
Gardner Denver Company
Hendrie and Bolthoff Company
Mine and Smelter Supply Company
M. L. Foss Company

CONNECTICUT

Bridgeport

Hunter and Havens Company

Derby

F. Hallock Company

Milford

Edgcomb Steel Company

New Haven

Crucible Steel Company of America

Waterbury

Charles A. Templeton
Valley Mill Supply

DISTRICT OF COLUMBIA

Washington, D. C.
J. B. Kendall Company

FLORIDA

Tampa
Cameron and Barkely Company

GEORGIA

Atlanta
★ Crucible Steel Company of America
J. M. Tull Metal & Supply Company

IDAHO

Pocatello
Paul Roberts
Wallace
Coeur d'Alene Hardware and Foundry Co.

ILLINOIS

Chicago
A. M. Castle Company
★ Crucible Steel Company of America
Steel Sales Corporation
Rockford
★ Crucible Steel Company of America
Eric J. Gustafson

INDIANA

Evansville
Orr Iron Company
Fort Wayne
Mossman Yarnelle Company
Indianapolis
★ Crucible Steel Company of America

KANSAS

Wichita
Aircraft Steel and Supply Company
Watkins, Inc.

KENTUCKY

Louisville
Neill Lavielle Supply Company

LOUISIANA

New Orleans
Dixie Mill Supply Company
Standard Supply and Hardware Co.
Shreveport
Dixie Mill Supply Company
Oliver H. Van Horn Company

MAINE

Bangor
Haynes and Chalmers Company
N. H. Bragg and Sons

Portland

E. Corey and Company

MARYLAND

Baltimore
Carey Machinery & Supply Co.
★ Crucible Steel Company of America
Seaboard Steel and Iron Company
Steel Specialties, Inc.

MASSACHUSETTS

Attleboro
Brownell Mill Supply Co.

Boston

★ Crucible Steel Company of America
H. D. Evans Steel Company
★ Arthur C. Harvey Company
Hawkrige Brothers Company
Wetherell Brothers Company

Lowell

Lowell Iron and Steel Company

North Attleboro

Franklin Hardware Company
Schofield Hardware Company

Springfield

★ Crucible Steel Company of America
Worcester
George F. Blake, Inc.

MICHIGAN

Battle Creek
Bard Steel and Mill Supply Company
Bond Supply Company

Bay City

Jennison Hardware Company
Meisel Hardware & Supply Co.

Detroit

A. J. Baxter and Company
Boyer Campbell Company
Craine-Schrage Steel Company
★ Crucible Steel Company of America
Garner-Shelton Company
G. L. Gransden and Company
McMullen Tool and Supply Co.
Steel Sales Corporation
Charles A. Streifinger Company
Tool Sales Company
Welding Sales & Engineering Co.

Grand Rapids

Grand Rapids Supply Company

Jackson

Smith Winchester Company

Kalamazoo

Bard Steel and Mill Supply Company
Bond Supply Company
Kalamazoo Mill Supply Company

Lansing

Mill Supplies Corporation

Muskegon

Factory Supply Company
Muskegon Hardware
Tower Hardware

Pontiac

Oakland Mill Supply Company

Port Huron

Marshall E. Campbell Hardware Co.

Saginaw

Morley Brothers

MINNESOTA

Cold Spring
Cold Spring Equipment Company

Duluth

Kelley-How-Thomson Company
Marshall-Wells Company
Zalk-Josephs Company

Minneapolis

Minneapolis Iron Store
Williams Hardware Company

St. Cloud

Granite City Tool Company

St. Paul

★ Crucible Steel Company of America
★ Metal Sales Company
Russell-Newman Supply Company

MISSOURI

Kansas City
Aircraft Steel & Supply Company
Ellfeldt Machinery & Supply Co.

The Faeth Company

St. Louis

Colcord Wright M. & S. Company
★ Crucible Steel Company of America
Stigo Iron Stores

MONTANA

Butte

Montana Hardware Company

Helena

A. M. Holter Hardware Company

NEW HAMPSHIRE

Manchester

John B. Varick Company

NEW JERSEY

Newark

★ Crucible Steel Company of America

NEW MEXICO

Albuquerque

J. Korber and Company

Vanadium

Mine Supply, Inc.

NEW YORK

Binghamton

Babcock, Hinds & Underwood, Inc.
Charles Millar and Son Company

Buffalo

★ Crucible Steel Company of America
Enos and Sanderson
R. C. Neal Company
Seneca Steel Service, Inc.
Weed and Company

Elmira

Le Valley, McLeod Kinkaid, Co., Inc.

Jamestown

Clark Hardware Company

Long Island City

Bayonne Steel Company

New York

★ Crucible Steel Company of America

Rochester

The Sidney B. Roby Company

Syracuse

★ Crucible Steel Company of America
Drennan Steel Products Corp.
Syracuse Supply Company

Utica

Charles Millar and Son Company

NORTH CAROLINA

Asheville

Tidewater Supply Company

Raleigh

Dillon Supply Company

Wilmington

Hywan Supply Company
Mill & Contractors Supply Company

OHIO

Akron

Akron Welding & Spring Company
Hardware and Supply Company

Alliance

State Service and Supply Company

Canton

Canton Hardware Company

Cincinnati

★ Crucible Steel Company of America

Cleveland

Betz-Pierce Company
W. Bingham Company

**THOUSANDS OF TONS OF QUALITY
STEELS AVAILABLE FROM CRUCIBLE'S
NATION-WIDE WAREHOUSE POOL OF
STOCK.**

★ Crucible's Branch
Warehouses and
Sales Offices
● Crucible
Distributors

Cleveland Tool & Supply Company
★ Crucible Steel Company of America
Strong, Carlisle and Hammond
William Pattison Supply Company

Columbus
Columbus Hardware Supplies
Smith Brothers Hardware Company

Dayton
Quality Steels, Inc.

Toledo
Bostwick-Braun Company

Youngstown
Stambaugh-Thompson Company

OKLAHOMA
Oklahoma City
Midke Supply Company

Tulsa
Machine Tool and Supply Company
Marshall Supply & Equipment Co.

OREGON
Portland
Woodbury and Company

PENNSYLVANIA
Allentown

M. S. Young
Lansford
Emco Supply Company

Philadelphia
Cassanave Supply Company
★ Crucible Steel Company of America
Maddock and Company
Morris Wheeler and Company, Inc.

Pittsburgh
Chandler-Boyd Company
★ Crucible Steel Company of America
Gage and Supply Company

Scranton
Bittenbender Company

RHODE ISLAND
Pawtucket
William K. Toole Company

Providence
Z. Berberian Company
City Hall Hardware Company
★ Crucible Steel Company of America
Farr and Read Company
Hanson and Lapham
Miller-Sherman Company
J. T. O'Connell Company
Providence Mill Supply Company
Rayhill and Greene Supply Co.
Read and Lundy, Inc.
Read and Purcell Company
William F. Miller Company
William J. Burns, Inc.

SOUTH CAROLINA
Columbia
Columbia Supply Company

Sumpter
Sumpter Machinery Company

TENNESSEE
Knoxville
Tennessee Mill & Mine Supply Co.

Memphis
Hays Supply Company

TEXAS
Dallas
Briggs-Weaver Machinery Company

El Paso
Mine and Smelter Supply Company
Zork Hardware Company
Houston
Steel & Machine Tool Sales Co.

UTAH
Salt Lake City
Gardner Denver Company
Industrial Supply Company
Mine and Smelter Supply Company
Salt Lake Hardware Company

VIRGINIA
Arlington
Southern Metal Distributors

Norfolk
Tidewater Supply Company

Richmond
Industrial Supply Company
Smith Courtney and Company

Roanoke
Rich Equipment Company

WASHINGTON
Everett
Agnew Hardware Company
Everett Hardware Company
Lloyd Company

Seattle
Aronson Hardware Company
Campbell Hardware & Supply Co.
A. M. Castle and Company
Cragin and Company
★ Crucible Steel Company of America
Eagle Metals Company
Peterson Wholesale Hardware Co.

Shelton
Lumbermans Mercantile

Spokane
Kilmer and Sons

Tacoma
Hunt and Mottet Company
St. Paul & Tacoma Lumber Co.
Washington Hardware Company

WISCONSIN
Milwaukee
★ Crucible Steel Company of America

CANADA
Montreal, Que.
Railway & Power Engineering Corp.
Ltd.

Hamilton, Ont.
Railway & Power Eng. Corp., Ltd.

Toronto, Ont.
★ Crucible Steel Company of America
Railway & Power Eng. Corp., Ltd.

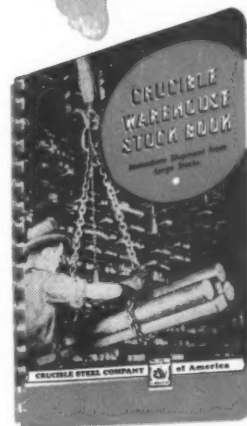
Windsor, Ont.
Railway & Power Eng. Corp., Ltd.

Vancouver, B. C.
Railway & Power Eng. Corp., Ltd.

Winnipeg, Man.
Railway & Power Eng. Corp., Ltd.

FREE!

Handy Stock Book—Lists
Crucible's full range of
Specialty Steels, available
through the Crucible
Warehouse and Distributor
Network. Also contains
helpful selection, use and
engineering reference
data. Describes Crucible's
service facilities.



Crucible Steel Company of America
Dept. C 1, 405 Lexington Ave., New York 17, N. Y.

**Kindly send me a copy of the CRUCIBLE
WAREHOUSE STOCK BOOK:**

Name _____ Title _____

Company _____

Street _____

City _____ Zone _____

State _____

CRUCIBLE STEEL COMPANY  **of America**

Chrysler Building, 405 Lexington Ave., New York 17, N. Y.

**Branches, Warehouses and Distributors
in Principal Cities**

**Consult Telephone Directory or
Thomas' Register for Nearest Office**

How Lebanon


19...

22...

205

Meet LOW TEMPERATURE Service Requirements

IN selecting casting alloys for low temperature service, it is especially important that information about physical properties be reliable. The charts shown are based on information gained during Lebanon's long experience in producing castings for service at temperatures ranging from 32° F. to -300° F. ... and upon Lebanon's extensive investigations in the field of low temperature operations.

Lebanon produces two types of casting materials for use at low temperatures: ferritic steels for ser-

vice to -150° F. (Circle ① 19 and Circle ① 205); austenitic steel for service below -150° F. (Circle ① 22). Accurate information on the impact properties of these three steels is presented on the charts opposite. All data is influenced by variables in design, section variations and gradients.

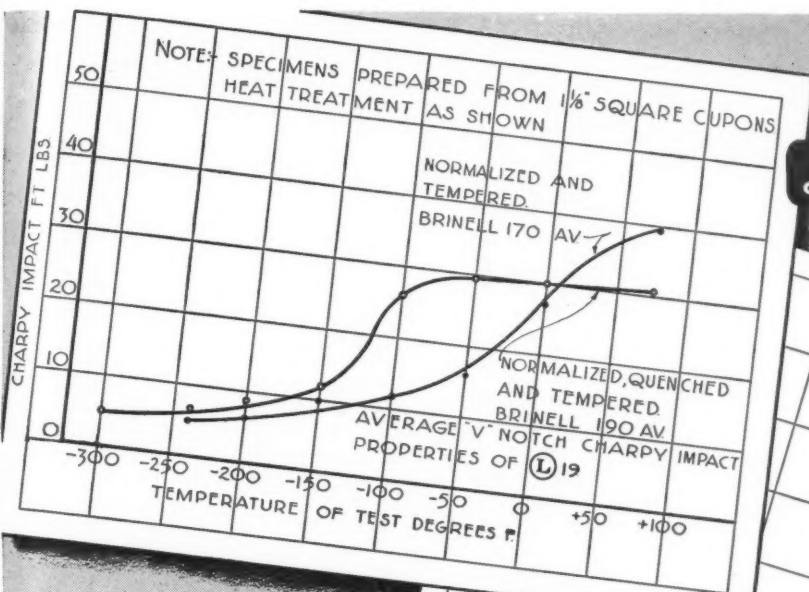
Lebanon is prepared now to cooperate with you in design and materials selection for castings for low temperature operation. Write stating your service conditions.

LEBANON STEEL FOUNDRY • LEBANON, PA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

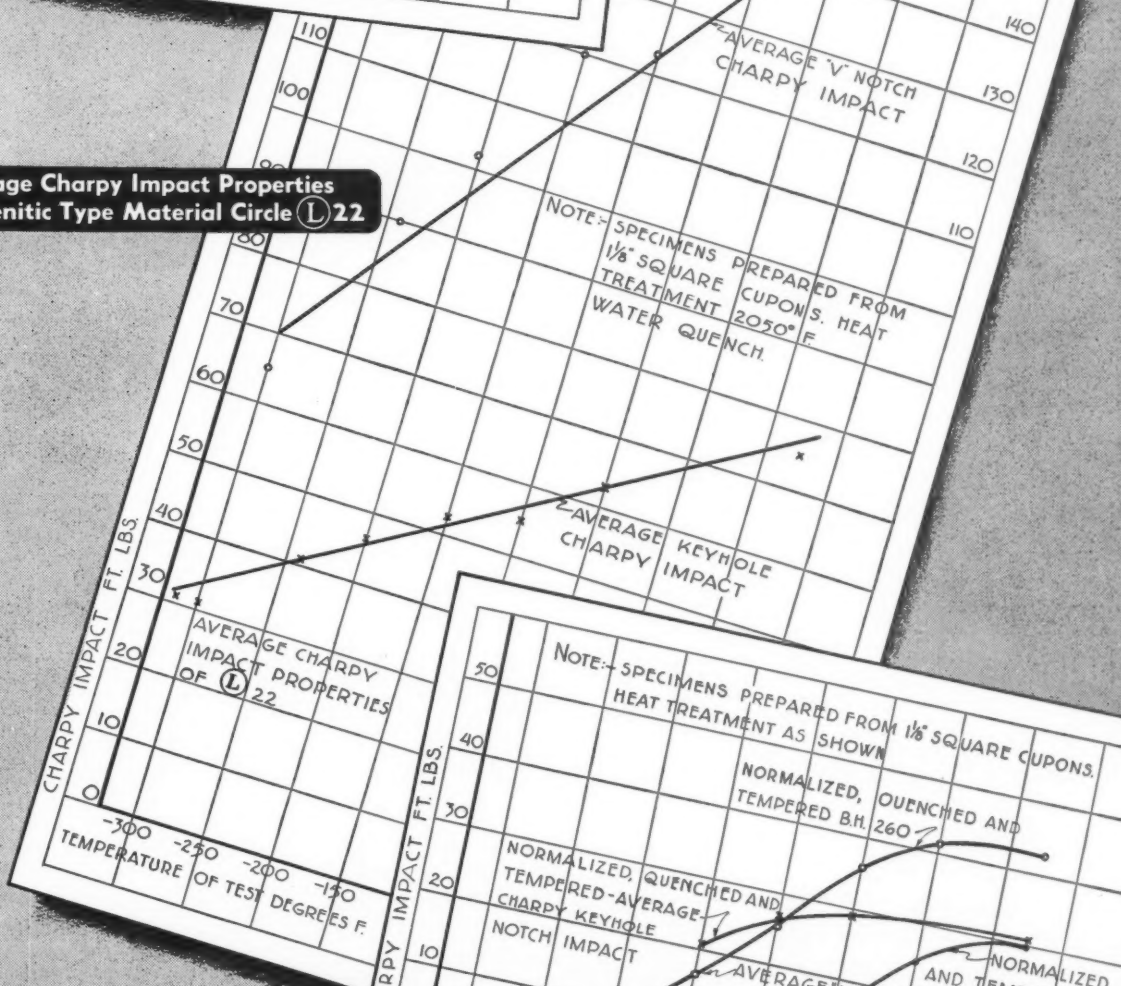
"In the Lebanon Valley"

***Lebanon* ALLOY AND**

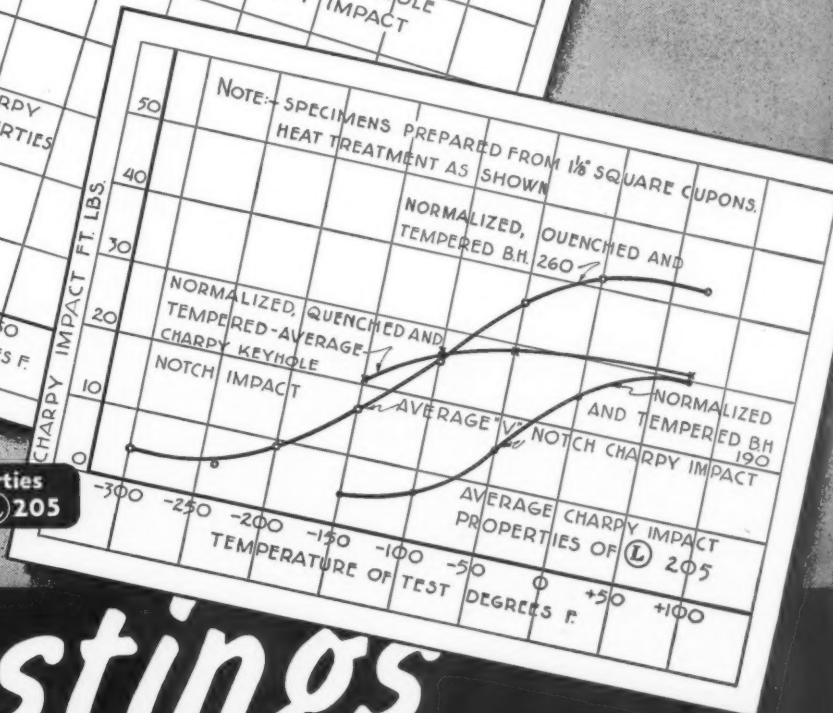


Average Charpy Impact Properties of Ferritic Type Material Circle (L) 19

Average Charpy Impact Properties of Austenitic Type Material Circle (L) 22

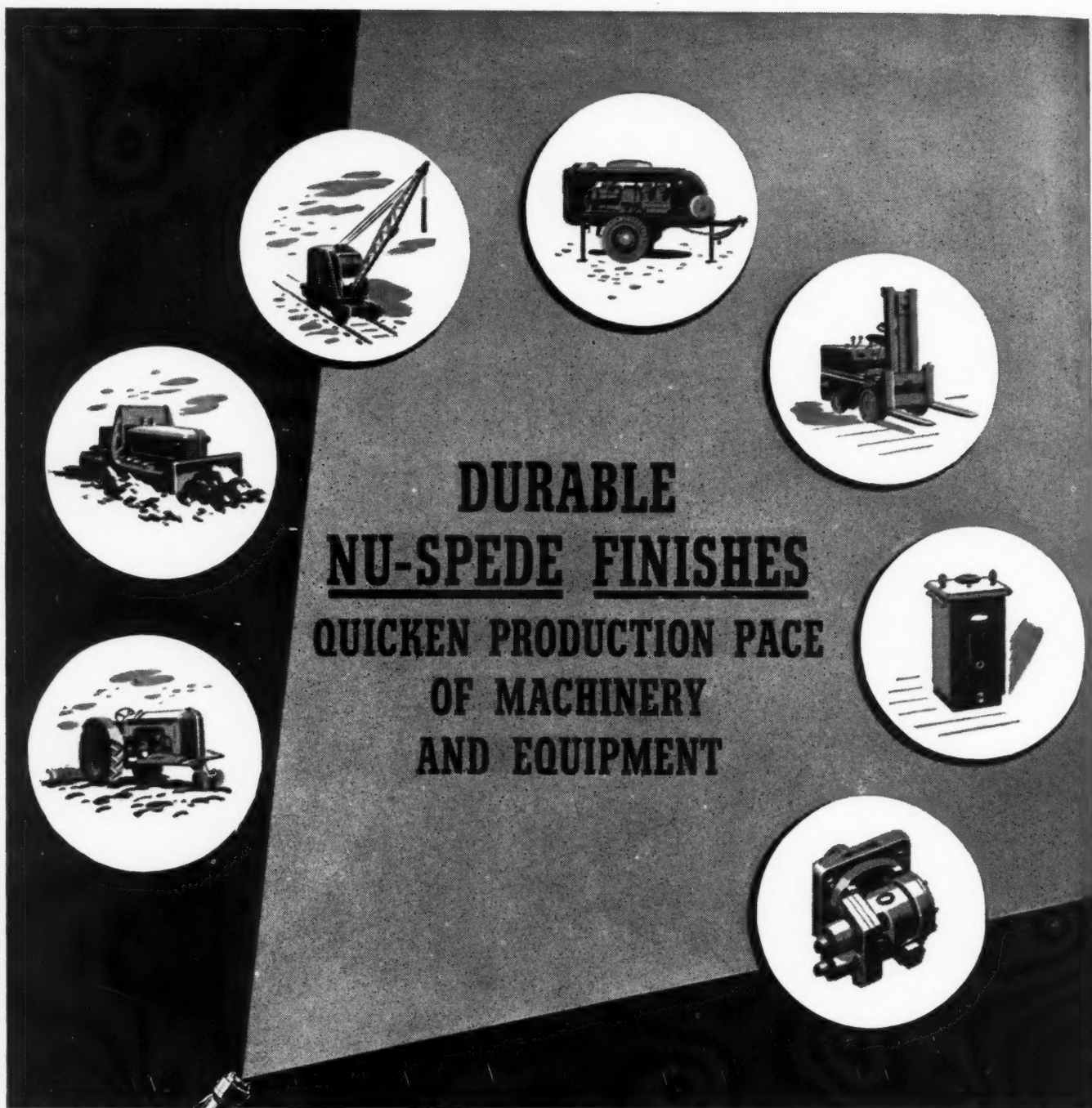


Average Charpy Impact Properties of Ferritic Type Material Circle (L) 205



STEEL

Castings



Fast-drying, durable Nu-Spede finish shortens production time and adds enhancing lustre to agricultural implements, road machinery, cranes, compressors, hoists, welding, pumping, and similar equipment.

Quickly applied, Nu-Spede sprays on smoothly and air-dries dustfree in just 15 minutes. It hardens overnight to a mirror-smooth finish that "sets-

off" any product. Nu-Spede bakes at 140° in just one hour without injury to wood, glass or rubber. It bakes in even shorter time, at higher temperatures, on all-metal construction.

Nu-Spede is excellent coating for aluminum, steel or wood surfaces. It can be applied over Nu-Spede Primer *after only 10 minutes of air-drying*, thus eliminating time-wasting between coat baking.

Remarkably weather-resistant, as

demonstrated by tests of extreme exposure to Florida sun, Nu-Spede gives attractive climate-defying protection.

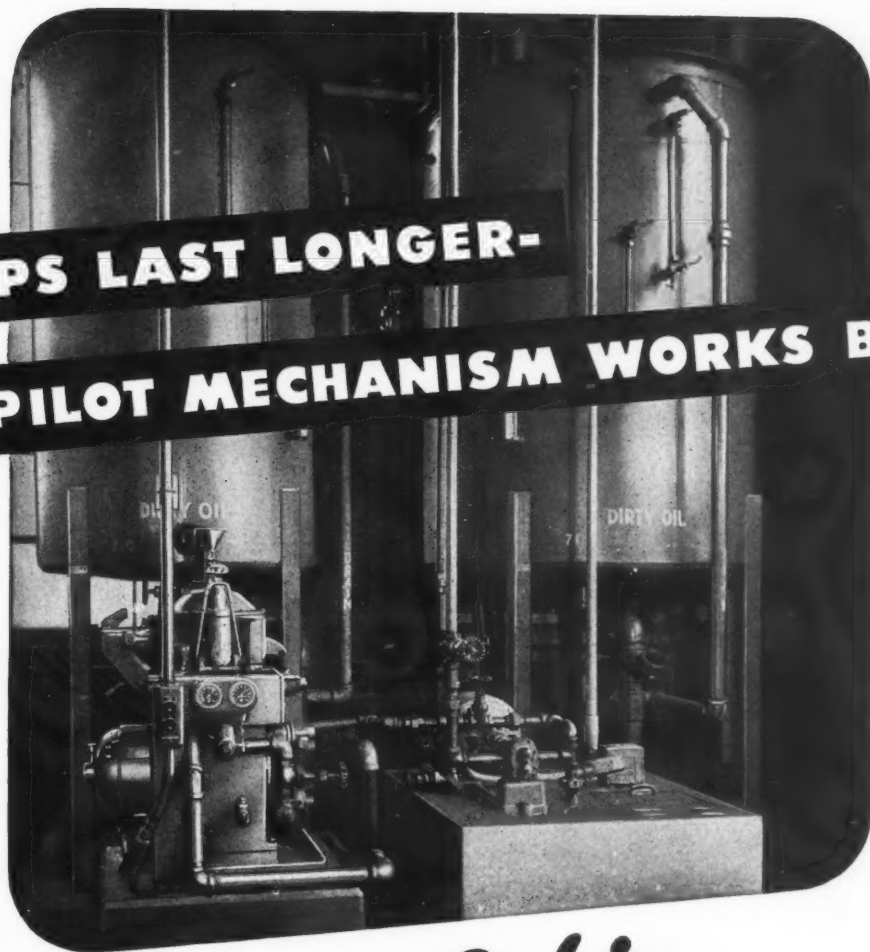
Nu-Spede fulfills every requisite of a long wearing, top quality finish—yet cuts production time. For full particulars on the application of Nu-Spede to your product, write

INDUSTRIAL SALES
THE LOWE BROTHERS COMPANY
DAYTON, OHIO

Lowe Brothers
FINISHES for Industry

PUMPS LAST LONGER-

PILOT MECHANISM WORKS BETTER...



When the Oil is Purified!

PURIFICATION of hydraulic oil by means of a De Laval Centrifugal Oil Purifier accomplishes two important results: (1) Pumps used for maintaining the necessarily high pressures in hydraulic cylinders will last longer and require less attention; (2) Danger of pilot mechanism sticking will be minimized.

De Laval oil purification units similar to that shown above maintain at peak efficiency many other kinds of

factory oils by removing dirt, grit, metallic particles and water. Included are cutting oils, test oils, washing oils, honing oils, slushing oils, and many others.

Another centrifugal, the De Laval "Hermetic" Coolant Clarifier, by removing harmful abrasives from grinding coolant, permits grinding to closer limits, prolongs wheel life, and enables finer finishes to be produced.

● Write for Bulletin FF.

DE LAVAL

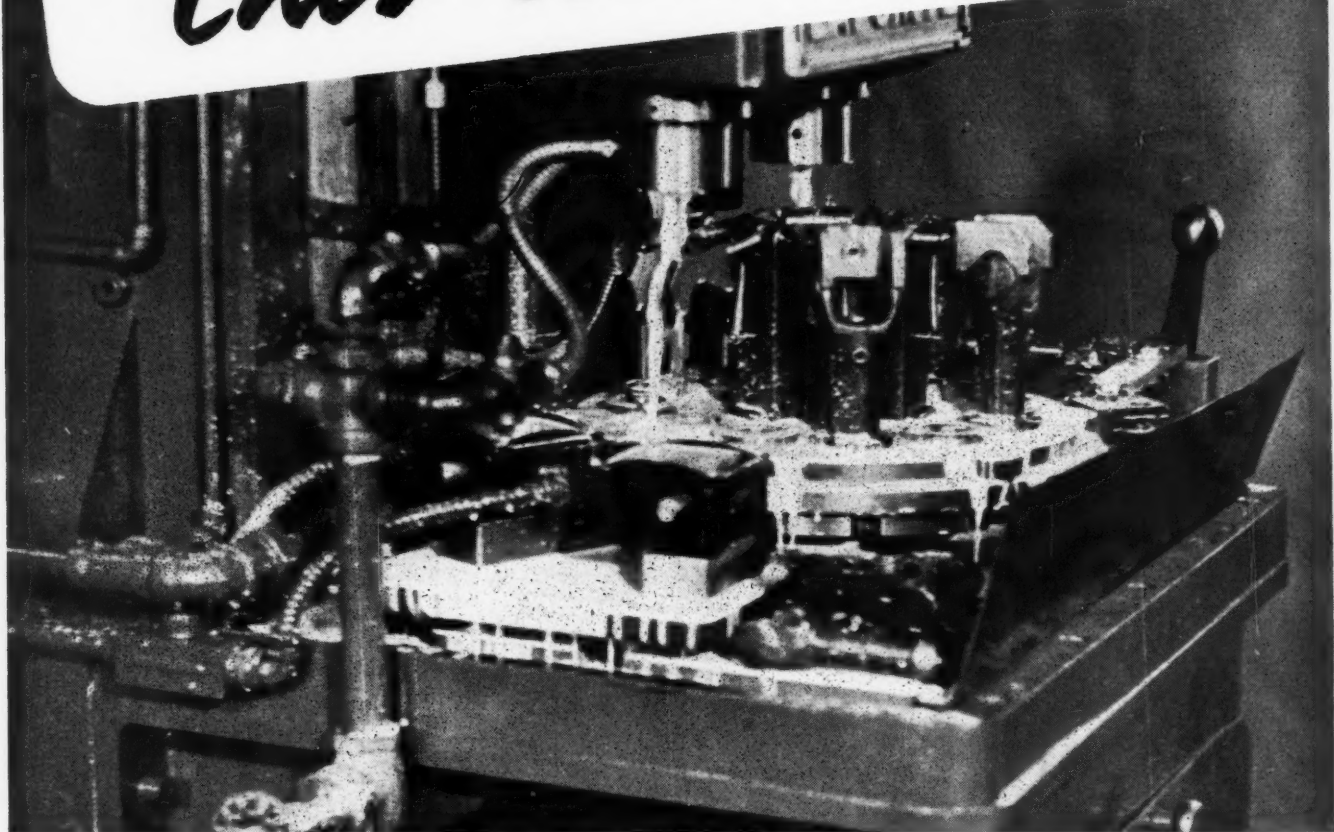
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6

DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19

THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

PURIFIERS AND CLARIFIERS FOR FACTORY OILS

Emulsifying **TOOLTEX** *Cuts* **CUTTING COSTS**



IF COSTS are excessive on high speed cutting operations where a straight cutting oil is applied, try a soluble oil which combines unusual cooling properties with maximum lubricating qualities.

Such an oil is Sinclair TOOLTEX, which mixes readily to form a stable emulsion that does not deteriorate excessively with use. For this reason, oil consumption is held to a minimum.

TOOLTEX makes for clean machines. It leaves no gumming deposits...carries off small metal particles for proper disposition...won't injure operator's skin...doesn't become rancid from standing.

Let our engineers counsel you on TOOLTEX for use on hand screw machines and turret lathes, as well as for milling, drilling, planing and certain broaching operations.

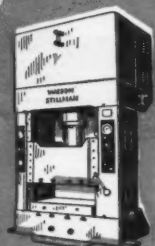
SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

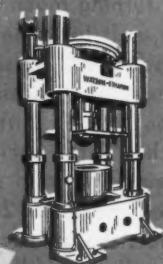




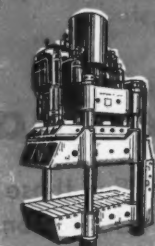
300 Ton
Double Action



200 Ton
Single Action



1500 Ton
Single Action



800 Ton
Double Action



1000 Ton
Single Action

DEEP DRAWING

THE HYDRAULIC WAY



250 Ton
Metal Forming Press

This Watson-Stillman Double Action Press has high action speed, extreme flexibility of control, and versatility to meet the most exacting performance requirements.

Adjustable automatic slow-down just before die contact makes it possible to utilize a very rapid advance stroke without danger of high impact forces. Automatic reversal at a positive predetermined pressure insures the press and dies against overloading.

Individual pressure control and recording gauge is provided for each of the four corners of the blankholder, permitting

"more slide" at certain points of the blank than others, when drawing irregular shaped parts. Die cushion has independent pressure control and can be either single or double acting to suit particular needs.

"Ruggedness" and "Dependability" are bywords of the product with which the Watson-Stillman Company has served the Metal Forming Industry for almost a century. Add to this the most modern engineering skill obtainable and you have the answer to your own particular, intricate problem. Write today for information.

1039

WATSON-STILLMAN

HYDRAULIC MACHINERY DIVISION

FACTORY AND MAIN OFFICE
ROSELLE, NEW JERSEY

BRANCH OFFICES
PHILADELPHIA, PA. NEW HAVEN, CONN.
CHICAGO, ILL.

REPRESENTATIVES

WASHINGTON, D. C. Ralph Payne (R. R. Equip.)
INDIANAPOLIS, IND. W. K. Millholland Machinery Co.
CHICAGO, ILL. E. L. Essley Machinery Co.
MILWAUKEE, WIS. E. L. Essley Machinery Co.
ST. PAUL, MINN. Anderson Machine Tool Co.
SAN FRANCISCO, CAL. Jenison Machinery Co.
NEW YORK, N. Y. Eastern Railway Supplies, Inc.
(R. R. Equip.)

PITTSBURGH, PA. Stanley Berg & Co.
CLEVELAND, O. Frank T. Goetz Machinery Co.
DETROIT, MICH. Peninsular Machinery Co.
GRAND RAPIDS, MICH. E. L. Essley Machinery Co.
LOS ANGELES, CAL. Hoffman and Heartt
DALLAS, TEX. Perry Machinery Co.
HOUSTON, TEX. Perry Machinery Co.
TULSA, OKLA. Perry Machinery Co.

CANADA: Canadian Fairbanks-Morse Co., Ltd. • Branches in All Principal Cities

MANUFACTURERS OF THE MOST COMPLETE LINE OF HYDRAULIC MACHINERY

MACHINERY, June, 1946—107

Where do YOU want to go

FROM HERE?



● This is the Oster "RAPIDUCTION" Standard turning machine No. 601 as it looks before it is adapted to specific needs. This basic machine can be furnished with Worm Drive or Direct Drive and with 4-speed motor or 2-speed motor. Automatic chuck capacity is 1½" (round bar stock).

You Can Start with this **STANDARD** Chassis

Not a single "unwanted" part is on the basic No. 601 machine. From here, our engineers can readily adapt this machine to your EXACT needs. This makes it possible to quickly develop a "special" machine at minimum cost. You gain the economy of a "standard" machine up to the point of where you need to adapt it to "special" conditions.

The Oster No. 601 "RAPIDUCTION" is still obtainable with either the automatically indexed, 6-position turret or with plain

saddle and single tool post. But those are only two of many possible adaptations of the basic machine. Either lever or screw feed cross slides are available as well as a wide variety of air or manually operated chucking equipment.

If you believe (as many others have) that this basic machine merits careful consideration, address your inquiry to . . .

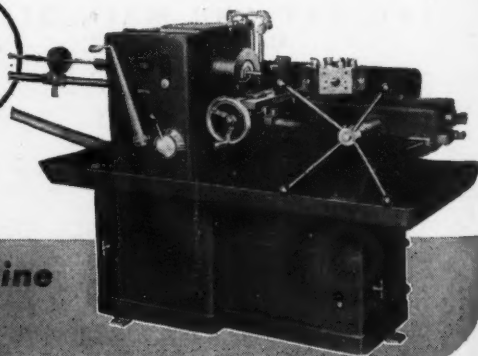
THE OSTER MANUFACTURING CO.

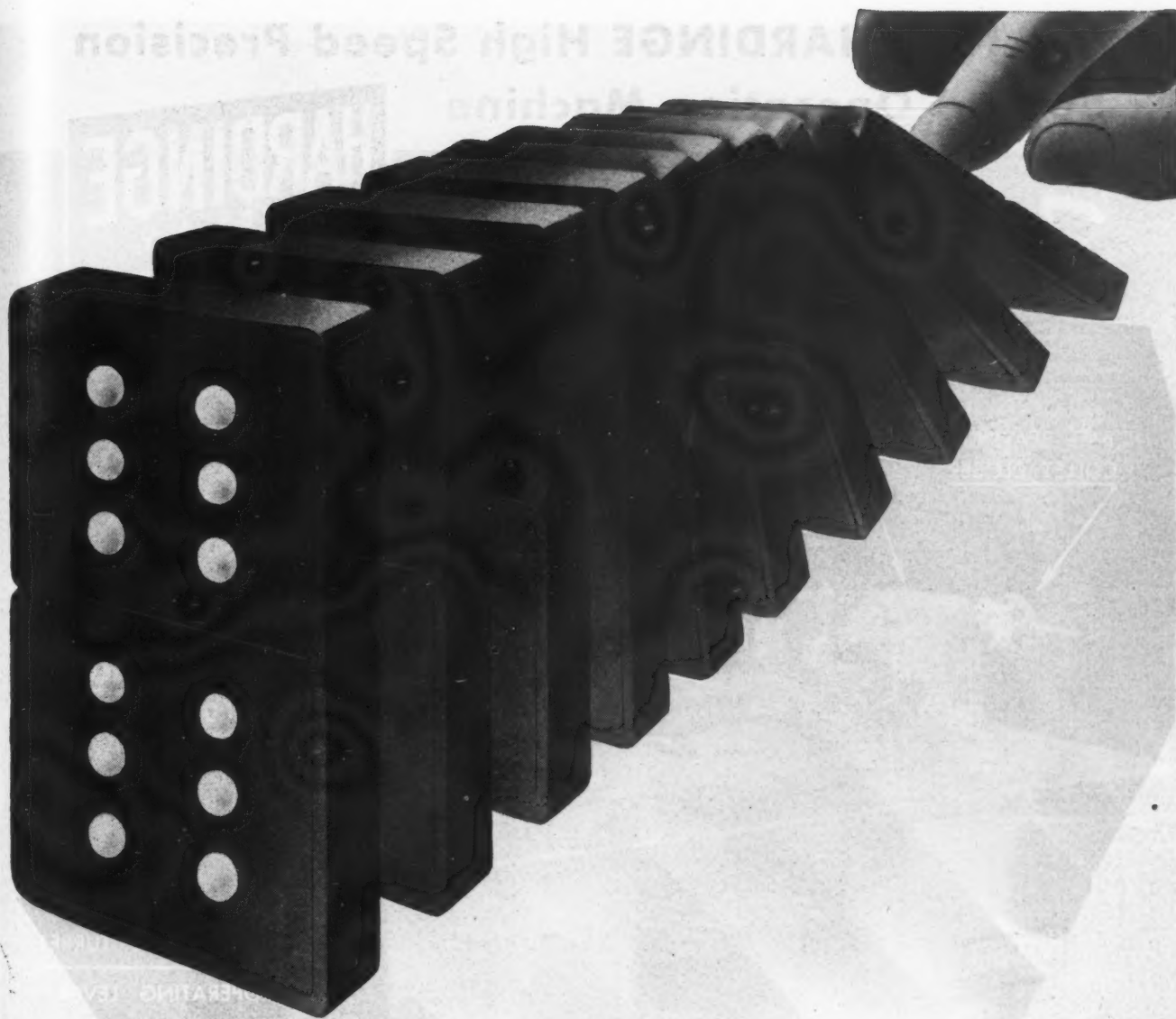
2073 East 61st Street • Cleveland 3, Ohio, U.S.A.



"Rapiduction"

The **STANDARD** Turning Machine
with **CUSTOM-BUILT** Features!





ONE DOWN . . . ALL DOWN

When you hook up a factory-full of machines into one continuous production line . . . a million dollars worth of machines working as one machine . . . and you start it going, **IT'S GOT TO GO.** Sometimes, as in the textile, paper and paint industries, it's got to keep going for as long as 8000 hours a year. That puts it up to every single machine to keep going because one down, for repairs or maintenance, means all down.

Which puts a lot up to the bearings. That's the reason so many concerns in continuous process industries put their bearing problems up to Fafnir. In the textile industry, for instance, Fafnir designed ball bearing units for sixty or more different types of machines . . . units that slip

right in place of hard-to-maintain plain bearings. And such units as the cartridge type ball bearing where completely housed units are needed. When the production runs are long, machines need every bit of the precision manufacturing and testing that Fafnir Ball Bearings get. And they need the Fafnir lubrication seals . . . to keep the lubrication where it's needed and away from products like textiles and paper where a single drop can cause costly spoilage.

Of course it takes more than one or two features to account for the preference of machine designers and users for Fafnir Ball Bearings. It takes the Fafnir way of looking at ball bearings from the machine end of the job. The Fafnir Bearing Company, New Britain, Connecticut.



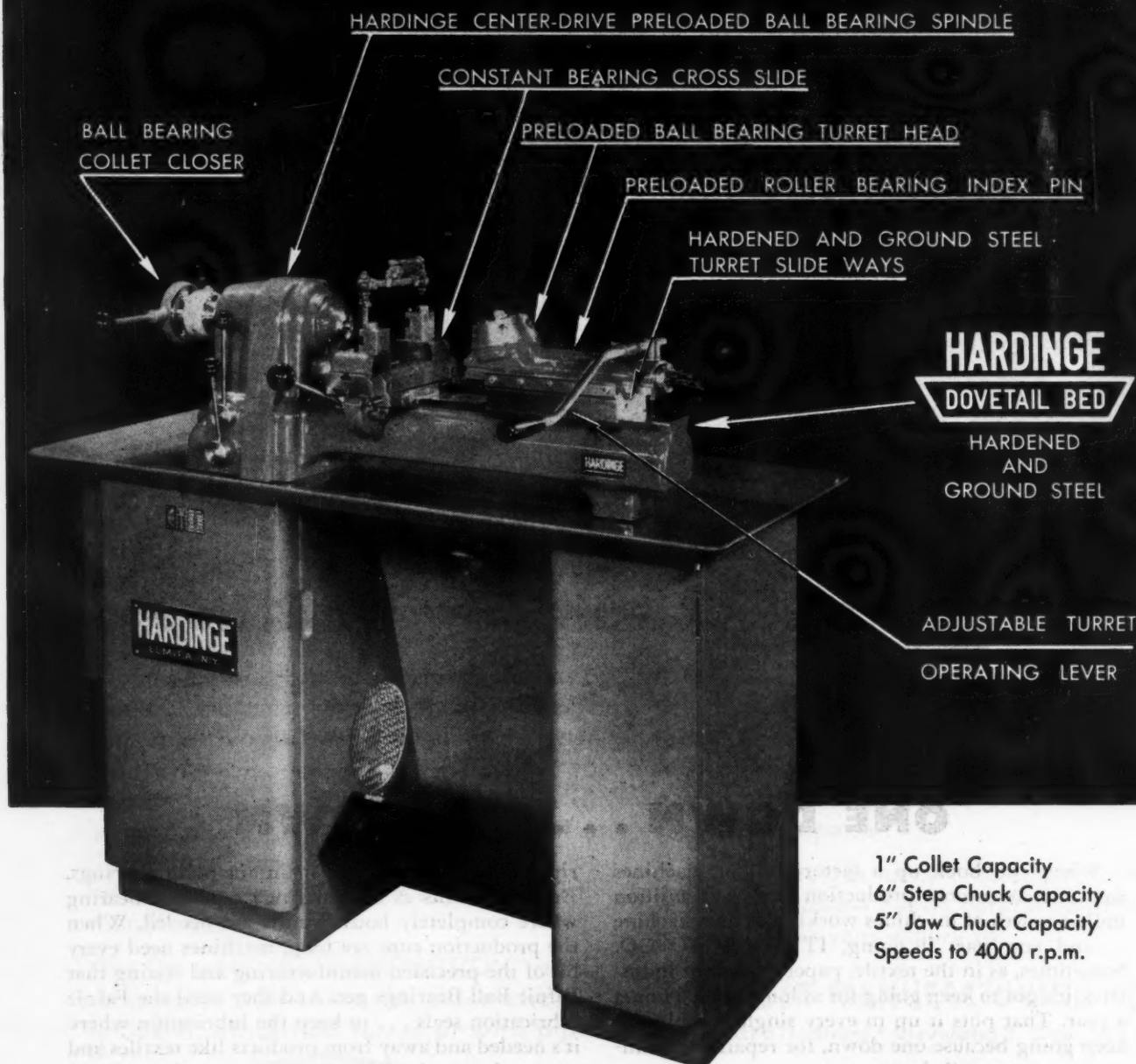
MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

The New HARDINGE High Speed Precision Second Operation Machine

HARDINGE
ELMIRA, N.Y.

Features:

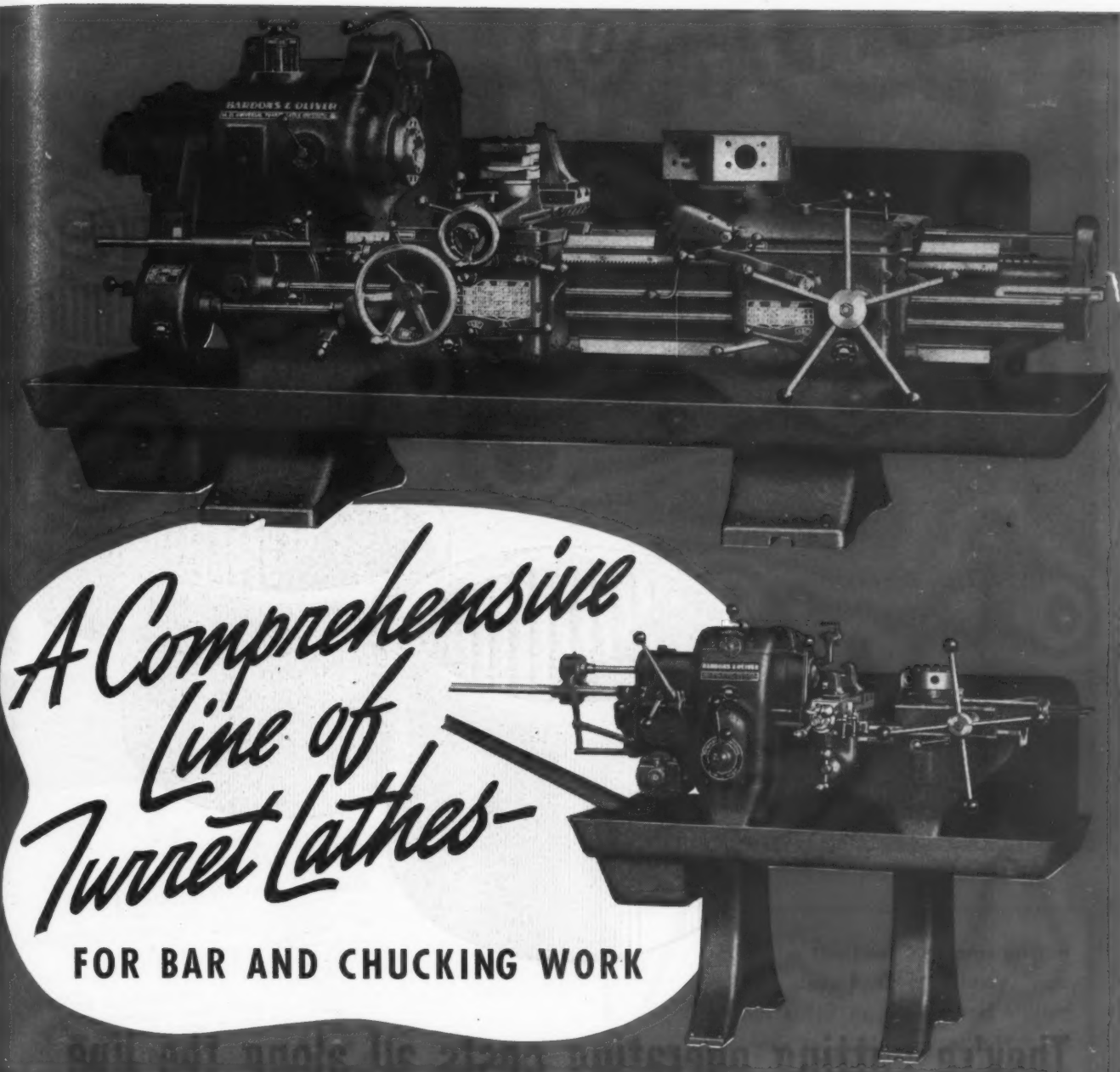


1" Collet Capacity
6" Step Chuck Capacity
5" Jaw Chuck Capacity
Speeds to 4000 r.p.m.

The above features assure sustained accuracy. The performance features of the previous model have been retained. This is the outstanding machine for high speed production of second operation work. Ask for bulletin DSM 59.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



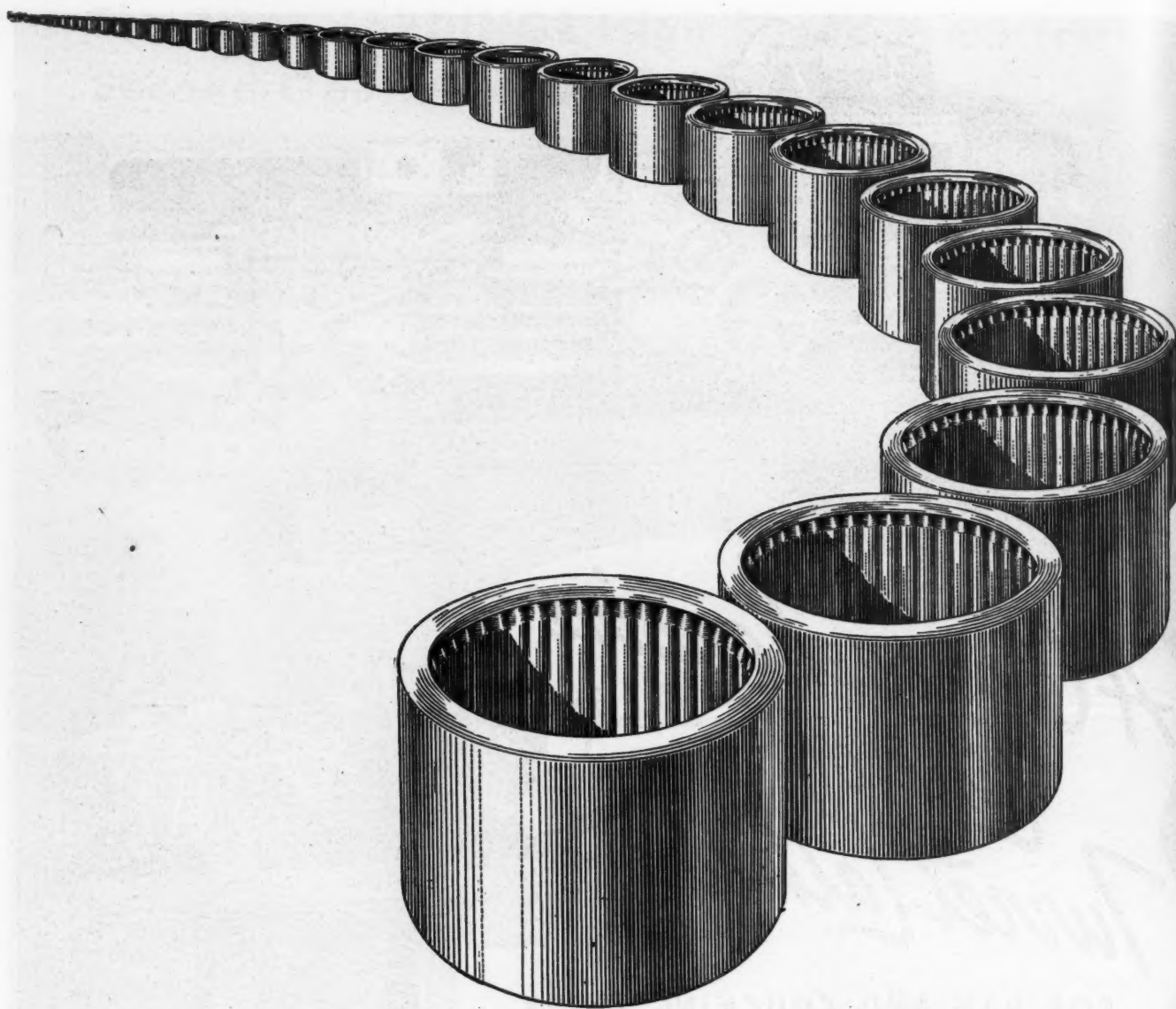
The range of the Bardons & Oliver line of turret lathes covers bar work from 1/8 inch diameter or smaller to forgings or castings up to 15 inches. Each size in the line is outstanding in its own field for fast production and high quality work. In this era of keen competition

and high wage standards Bardons & Oliver Turret Lathes will lower production cost and raise profit margin.

We suggest you submit your production problems and blue prints of your turret lathe work to our tool engineers for study and recommendation.

BARDONS & OLIVER, Inc.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO



They're cutting operating costs all along the line

Economy of operation is an inherent feature of Torrington Needle Bearings, and it shows up in the form of measurable cost savings all down the line. . . .

In power costs . . . The tremendous radial capacity of Needle Bearings, combined with their low coefficient of friction and equalized load distribution at operating speeds, assures minimum starting and running friction . . . less power consumption.

In lubrication costs . . . The close-fitting, turned-in lips of the hardened outer shell form a reservoir to retain the lubricant and distribute it evenly over all of the bearing surfaces. Thus, less frequent lubrication and maintenance are required, and bearing wear is reduced to the vanishing point.

In servicing or replacement costs . . . Needle Bearings

also contribute marked economies. They never seem to need attention, seldom if ever is a replacement required. This is due directly to their design, high load capacity and efficient lubrication.

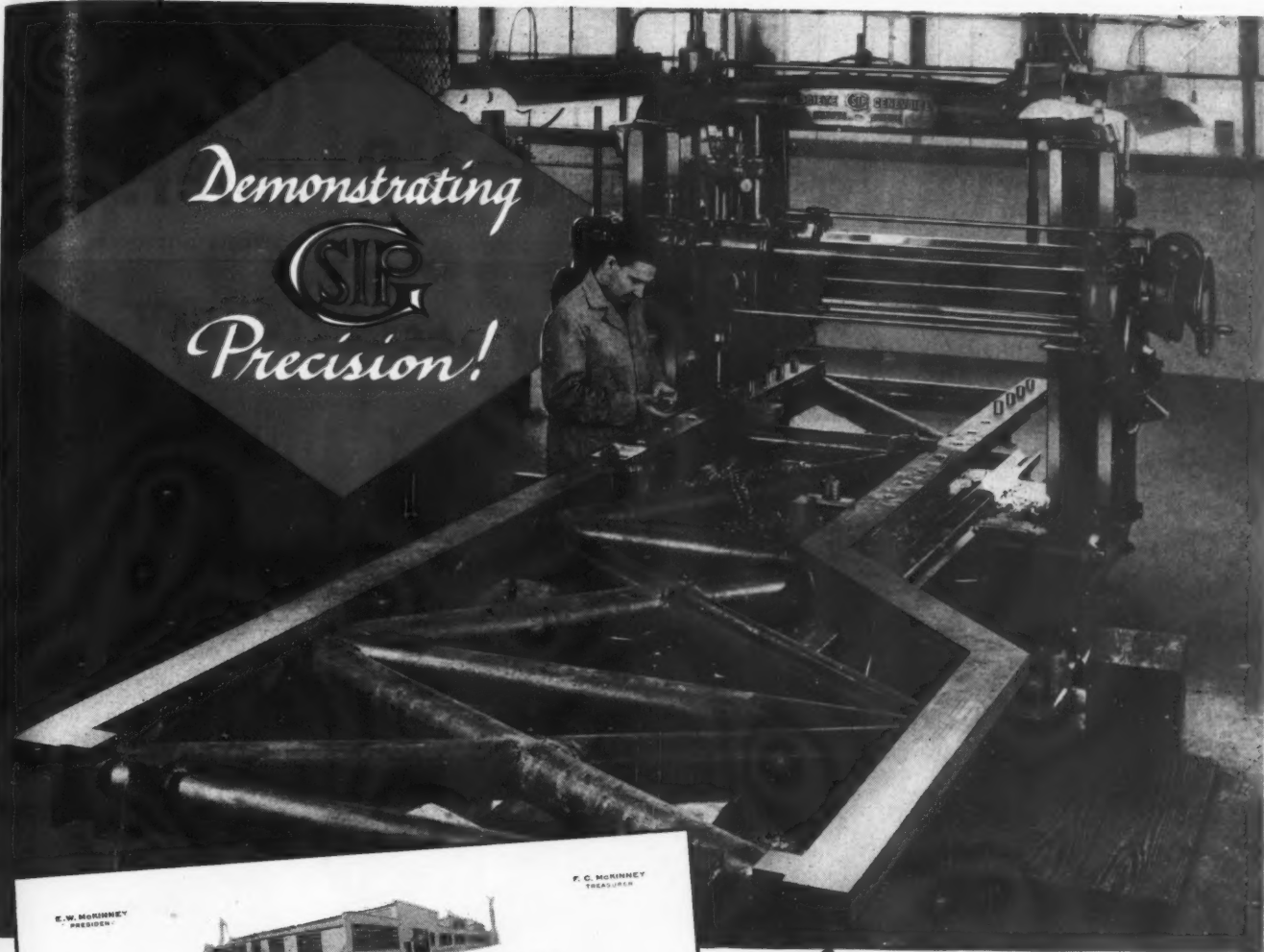
In your own industry, compact, low-cost Torrington Needle Bearings have solved innumerable friction problems. Our Catalog 32, copy of which is available upon request, will give you a comprehensive picture of Needle Bearing advantages as applied to the machines *you* design, build or operate.

THE TORRINGTON COMPANY
TORRINGTON, CONN. SOUTH BEND 21, IND.

Offices in All Principal Cities

TORRINGTON NEEDLE BEARINGS

Demonstrating
SIP
Precision!



E. W. MORRISSEY
PRESIDENT



F. C. MCKINNEY
TREASURER

THE MCKINNEY TOOL & MFG. CO.

1688 ARABELLA ROAD CLEVELAND 12, OHIO
DESIGNERS AND BUILDERS OF PRECISION TOOLING SINCE 1920
Complete Engineering Service

Cosa Corporation
5000 Chrysler Building
New York 17, New York

Gentlemen:

We purchased a SIP Jig Borer in 1936 and have used this machine continuously ever since. During the war years it ran twenty-four hours a day, seven days a week.

Ever since we have had this machine we have had it checked every year and outside of a few minor adjustments, it has never caused us any trouble.

We believe this machine to be by far the best Jig Borer on the market. We do work on this machine that cannot be done on any other Jig Borer. In fact we do quite a lot of custom work for people with other Jig Borers. If we were going to buy another Jig Borer, we would buy no other kind.

Thanking you for your cooperation in the past, we remain

Yours very truly

MCKINNEY TOOL & MFG. CO.

F. C. McKinney
F. C. McKinney

"... by far the best Jig Borer on the market", says F. C. McKinney, who has put a SIP Jig Boring and Milling Machine to the severest test of continuous operation on jobs like the one shown above.

World famous SIP Jig Borers combine the high precision needed for toolroom work with the speed and dependability of set-up and operation that keep labor costs low — even on direct production.

RANGE OF TABLE SIZES

No. 5G	43½" x 32"
No. 4G	27¼" x 23½"
Hydroptic-B	39¼" x 32"
No. 3K	21¼" x 15"
No. 2C	18" x 10½"

HIGH PRECISION MACHINE TOOLS

AND MEASURING INSTRUMENTS

C O S A
CORPORATION



CHRYSLER BUILDING
New York 17, New York

CLEVELAND Drills and Reamers

for Utmost Accuracy
and More Holes
Per Grind

Telephone
YOUR



The **CLEVELAND** TWIST DRILL
COMPANY
1242 EAST 49th STREET
CLEVELAND 14

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES
20 E. 124th ST., NEW YORK 7 • 9 NORTH JEFFERSON ST., CHICAGO 4 • 100 HOWARD ST., SAN FRANCISCO 2
200 EAST GRAND AVE., DETROIT 2 • 100 NORTH FIELD ST., DALLAS 1
E. F. BARRIS, LTD., LONDON W. 1, ENGLAND

"CLEVELAND"
DISTRIBUTORS EVERYWHERE
ARE READY TO SERVE YOU



SEES MANY

GOOD THINGS AHEAD

It is reported that

General Electric engineers have devised a method of measuring the temperature inside a gas turbine by making some of the parts of a special chrome cobalt alloy which changes color with increasing heat.

get ready with CONE for tomorrow

New Holland Machine Co. expects to be ready to market a new flame cultivator that is expected to weed cotton at a cost of less than fifty cents an acre.

get ready with CONE for tomorrow

Patent 2,393,594 covers the use of ammonium nitrate in liquid anhydrous ammonia as a fuel for internal combustion engines. Since this fuel contains its own oxygen, an engine using it could operate at high altitudes without dependence on the atmosphere.

get ready with CONE for tomorrow

A novel automobile, designed by Preston Tucher of Ypsilanti, Michigan, now in the road-test stage of development, is reported to have many unique features, such as front fenders that turn with the wheels, three headlights that are dimmed by a photo-electric cell, sealed radiator and center steering wheel. The two-, four- or six-cylinder opposed engine has an aluminum block and fuel injection, but no flywheel and is placed between the two rear wheels. A liquid "torque converter" replaces clutch, transmission, drive shaft and differential.

get ready with CONE for tomorrow

Businessmen will soon be offered a triangular desk made of novel woods by Fletcher Aircraft Corp. of Pasadena.

get ready with CONE for tomorrow

New York Central has a hot box alarm on its new passenger cars that signals by both smoke and smell.

Pennsylvania Railroad has a new machine that prints tickets as they are sold and also takes care of the ticket seller's bookkeeping.

get ready with CONE for tomorrow

Sacro Mfg. Corp. of Bethlehem, Pennsylvania, has an under-the-sidewalk electrical snow-melting system, designed by A. M. Byers Co., that is set in operation by the weight of snow.

get ready with CONE for tomorrow

General Electric expects to deliver the country's most powerful electric locomotive in 1946: weight 500 tons, length 143 feet, 8000 horsepower.

The Bell System will test mobile radio-telephone service for automobiles on three highways: New York-Albany-Buffalo, Chicago-Springfield and New York-Boston.

get ready with CONE for tomorrow

The modern trend in retail store architecture has resulted in the triple expansion of the Pittsburgh Plate Glass Company's Pittco plant, that makes metal trim for all glass store fronts.

get ready with CONE for tomorrow

One of the new ideas in jet engines, developed by Carney Associates Ltd., New York, has two cylinders firing alternately and intermittently in such a way as to make rotating parts for air supply unnecessary.

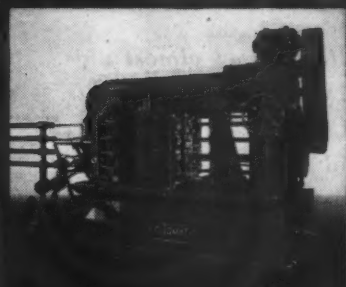
get ready with CONE for tomorrow

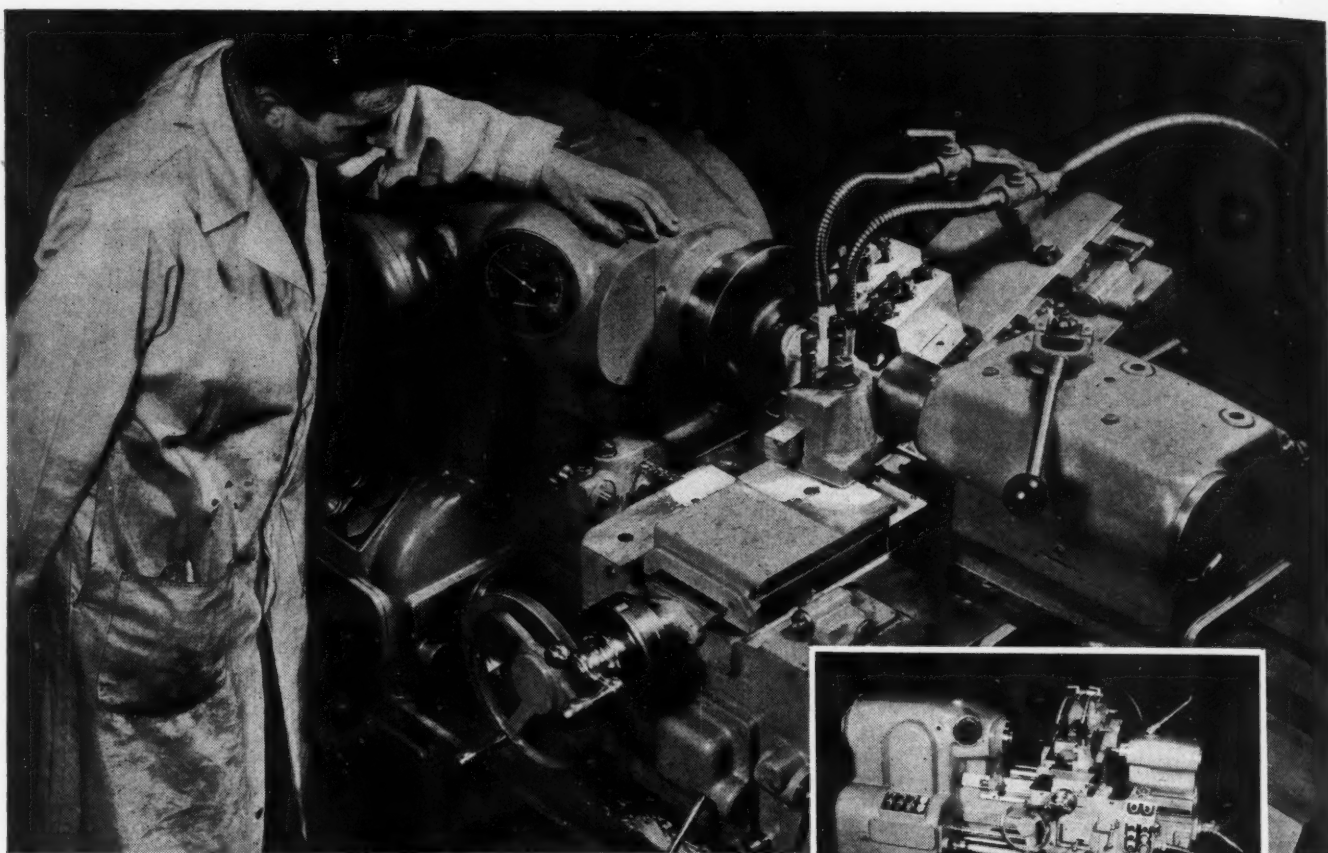
Pontiac, Michigan, is experimenting with a small house, one-third of which is rolled aluminum. It is not prefabricated, but built on the site.

FOUR



IN ONE!





You'll get peak production

AT A PROFIT — with the *Mona-Matic**

Fully automatic cycle—or fully manual—or any combination. Between-centers work as fast as carbide tools and modern metals can take it—spindle speeds up to 1000, 2000, 3000 and even 5000 RPM.

That's the kind of work you can do on the Mona-Matic. Regardless of exacting tolerance requirements, you'll get floor-to-floor time you'd ordinarily think of only in connection with specialized one-purpose machines—and at the corresponding low machining costs usually restricted to mass production methods.

Yet with the Mona-Matic you'll have an almost universally adaptable machine—one you can use on big lots and small, year in and year out. The front carriage is built with power feed and rapid traverse return; the independent electrically controlled rear slide may be added as a separate unit.

* **MONA-MATIC** — Add this new name to your metal-turning dictionary — You'll be hearing a lot of it — wherever rising production costs are a factor. The *Mona-Matic* is Monarch's answer to this problem in the field of between-centers work. For chucking and fixture work it's the *Uni-Matic*; for hand screw machine work the *Speed-Matic*.

Get full details on these three new machines *now* — from your nearest Monarch representative — or write us direct.

The Monarch Machine Tool Co. • Sidney, Ohio



FOR BETTER—FASTER—MORE ECONOMICAL THREADING

Sign on the DOTTED Line



Threadwell COLD-TEMPER Taps are identified

- by the *color* dot on the shank (*red* dot for high speed cut thread, *white* for commercial ground, *blue* for precision ground)
- by the "*tap-capsule*"—each ground thread tap in its individual transparent plastic tube
- by their *greaseless rust-proofing*—never messy or sticky to handle

- by their *superior performance*—cold-tempering at 120° below zero makes them stronger yet less brittle, assures better threads and more of them per tap, on plastics and abrasive materials as well as on steels, cast iron and alloys.

There is a *Threadwell* distributor near your plant—geared to give your tap requirements intelligent *personal attention*. May we put you in touch with him?

DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS THROUGHOUT AMERICA Export Distributors

Canada — Bridge Machinery Company, Montreal
England — Skylux, Ltd., London
Brazil — Alfredo Kramer & Cia. Ltda.,
Rio de Janeiro, Sao Paulo
Mexico — W. Picard, Mexico, D. F.
John H. Graham & Co., Inc. of New York City
THROUGHOUT THE REST OF THE WORLD

THREADWELL KEYWAY CUTTERS

provide the fastest, simplest method of cutting keyways to standard width and any desired depth in gears, cutters, pulley hubs, couplings, etc. May be used in any press.

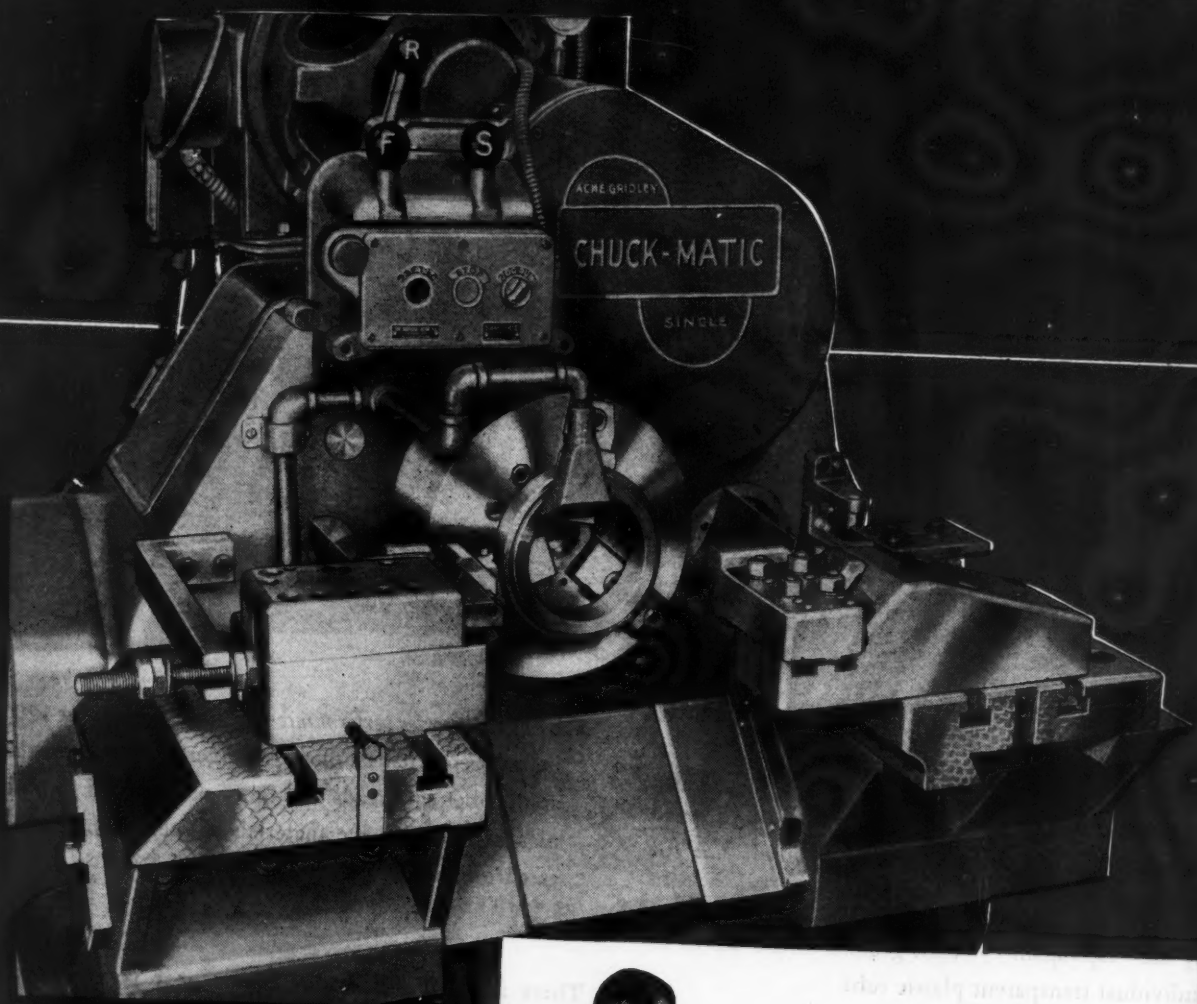
Threadwell offers an ideal Arbor Press for the purpose that is light, strong and inexpensive. Write for descriptive Bulletin.



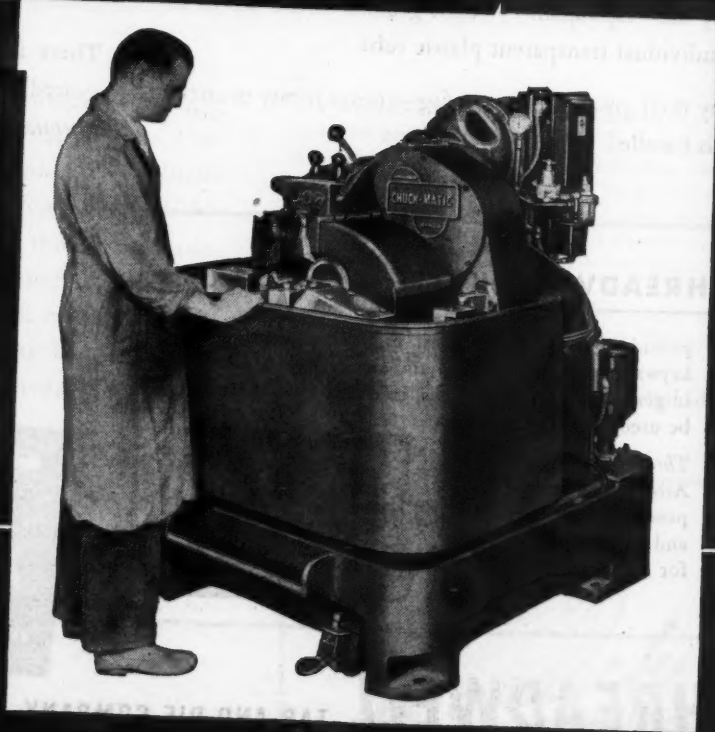
Threadwell
SINCE 1902
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.
CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

A *New* National Acme Machine..



**RADICALLY DIFFERENT
FROM ANY OTHER
SINGLE SPINDLE
MACHINE**



..the Acme-Gridley

CHUCK-MATIC

SINGLE SPINDLE 12" CHUCKER

For heavy duty, high production work on castings, forgings and tubing parts. Specializes on such primary operations as straight or taper boring, form boring or form turning, drilling, turning, forming, facing and chamfering.

The 12" Chuck-Matic is an entirely new design. It is an air-operated automatic, especially suited to cutting machine costs on short runs as well as long runs.

IT IS RUGGED—Heavy frame and new design gives you every advantage of modern tooling methods. Maintains precision, undisturbed by heavy feeds with high speed or carbide tipped tools.

IT IS FAST—Idle movements are cut to the minimum. Setup is quick and easy. Quick change from job to job. Adjustments easy through unusual accessibility.

UNSKILLED OPERATORS can run it. Automatic safety devices control both manual functions and mechanical movements—protecting operator, work and machine.

SPACE SAVING is a special advantage. Floor space required, 45" x 64". Convenient to locate. Operator can tend as many machines as job cycle times will permit.

★
THIS NEW BOOK—

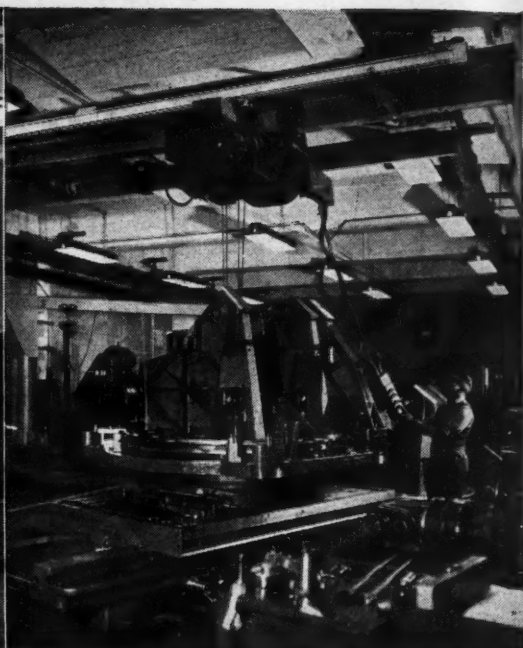
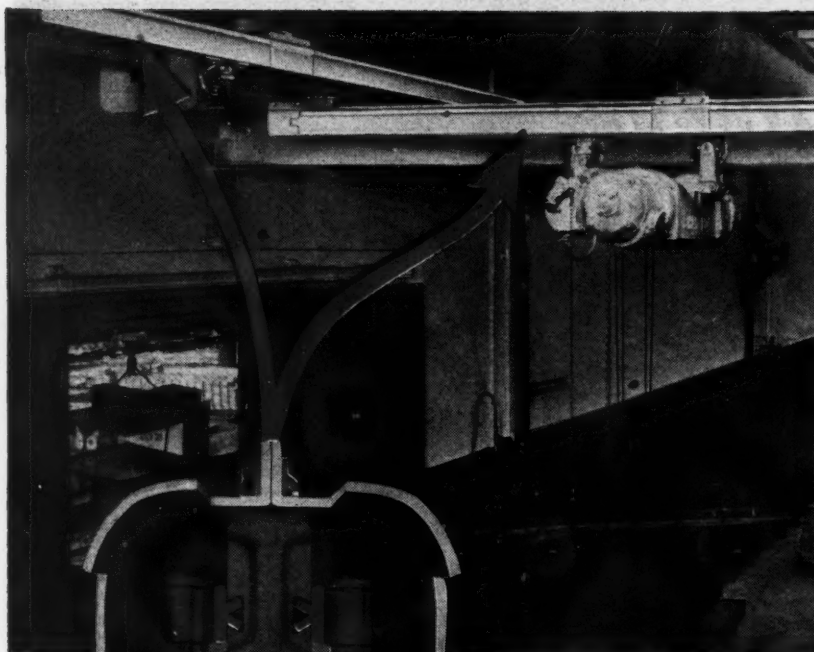
Bulletin SC-46 gives you complete details and specifications. Send for your copy.



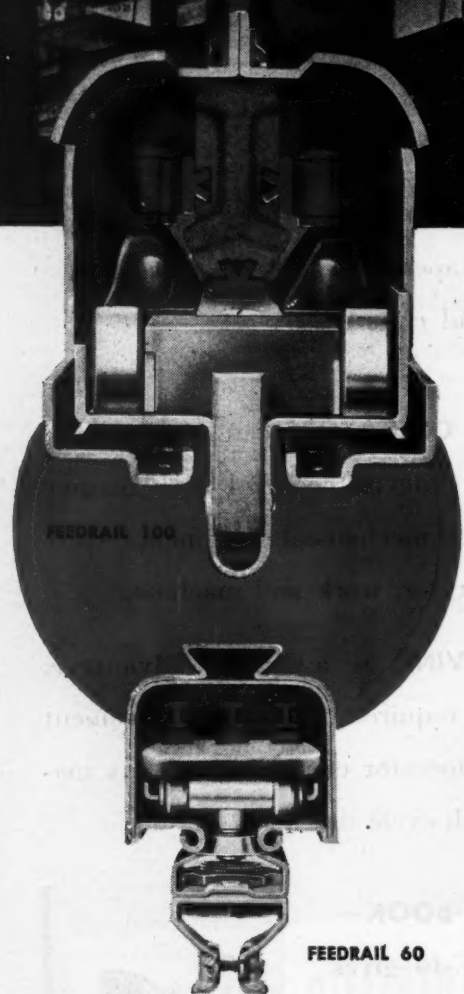
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids • Centrifuges • Contract Manufacturing



FEEDRAIL on main runways and bridges of cranes



Ask for
ELECTRIC FEEDRAIL
CATALOGS GENERAL No. 15
NEEDLE TRADES No. 16
MACHINE TOOL No. 17

MODERNIZE YOUR CRANES AND HOISTS WITH FEEDRAIL

Exposed trolley wires have no place in a modern plant. In a day's time, you can substitute the enclosed ELECTRIC FEEDRAIL System.

It requires little space, and is furnished in assembled units in stock lengths and curves. Also available for transfers and switches to fit any desired layout.

Feedrail is mechanically strong, electrically foolproof. Trolleys are completely polarized. All electrical parts enclosed, protected against dust — accidental shorts — mechanical injuries.

AND HIGH CYCLE TOOLS

Feedrail is also designed especially for high cycle and portable tools and is used extensively for moving test racks.

**ELECTRIC
FEEDRAIL**

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company

125 BARCLAY STREET • NEW YORK 7, N. Y.

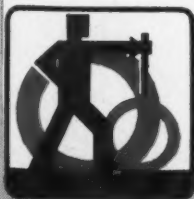
MILLING
Keyways



The vertical spindle is normally used for short keyways and for rounding ends of long keyways; the horizontal spindle for milling long keyways. The two spindles may be set to the same center line.

S P E C I A L L Y D E S I G N E D

- This machine was specially designed to mill wide keyways in large diameter shafts or cylinders. Keyways up to $2\frac{1}{2}$ " wide by 12' long may be cut at a single setting. Both the horizontal and vertical spindles are heavy and rigid. The resulting work is so accurate that it greatly reduces hand fitting.
- It is our business to design and build special purpose metal-cutting machines, tools, and work holding fixtures. We combine experience of over 50 years with a strictly up-to-the-minute approach to all problems that are presented to us. We will gladly discuss your needs with you.



INGERSOLL

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

JUST CHECK THIS LIST

- Hydraulic Presses, Bulletin 60
- Pneumatic Cylinders and Air Control Valves, Bulletin 57
- Hydraulic Cylinders, Bulletin 35
- Pneumatic Arbor Presses, Bulletin 46
- Centrifugal Quenching Presses, Bulletin 55
- "Hy-Power" Hydraulic Riveters, Bulletin 53
- Air Pressure Regulating Valves, Bulletin 56
- Pneumatic Vises, Bulletin 59

HANNIFIN

MACHINERY COMPANY



Champions

OF THE PRODUCTION LINE

THE largest users of Standard Red Shield Drills are the mass production industries:

Automotive, Aviation, Electrical, Farm Implement, Home Appliance, Railways

In a competitive age, low cost production provides the only reason why these industries select, specify and use Standard Red Shield Drills.

If you are concerned with production costs, why not talk with the Standard Man. Whether factory or mill supply distributor representative, he knows his business. He can give you also the benefits of our 65 years' experience in solving tough drilling, tapping, reaming and milling cutter problems. His services and suggestions are yours without cost or obligation. For prompt attention, call your Mill Supply Distributor or write



THE STANDARD TOOL CO.

CLEVELAND

NEW YORK STORE
94 READE STREET

DETROIT STORE
2457 WOODWARD AVE.

CHICAGO STORE
552 W. WASHINGTON BLVD.



Concerned with costs?
STANDARDIZE

FOR some time we have suggested that manufacturers might save by Standardizing on Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters and special tools.

We make these tools in one plant, under one management, with the same laboratory control of materials, the same skilled supervision, the same rigid standards of craftsmanship, test, and inspection.

Result, all are uniform in economical performance, all carry our Shield Brand as an assurance of merit.

Today, production costs are being studied as never before—for good reasons. Our suggestion to Standardize on metal cutting tools may have greater than ordinary profit possibilities for you, now.

Our representatives, and those of our Mill Supply Distributors from coast to coast are available to make suggestions if you desire. Call your Mill Supply Distributor, or write

THE STANDARD TOOL CO.

CLEVELAND

NEW YORK STORE
 94 READE STREET

DETROIT STORE
 2457 WOODWARD AVE

CHICAGO STORE
 552 W. WASHINGTON BLVD

Bryant Thread Gages

... An Entirely NEW PRINCIPLE in the Field of Thread Inspection



ANYONE who can push a lever, drop a part, and read a large dial gage, can inspect threads to any desired degree of accuracy on Bryant Thread Gages. That's how easy it is. There's no slow and tiresome threading of plug and ring gages into and onto the work. There's no "feeling" for the class of fit.

Combined with this ease of operation is speed. The Bryant Method is four or five times faster than plug or ring gaging. Because the method is so simple, this speed is attained by inexperienced operators on the first day.

Speed us the coupon for complete details.

Please send me Catalog No. G3 which gives complete details on the Bryant Thread Gages.

Name _____ Title _____

Company _____

Street _____

City _____ State _____

NEW



PORTABLE THREAD GAGES

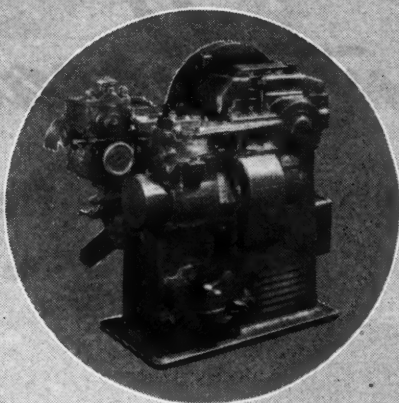
and Squareness of Face Gages, Universal Hole Size Gages, Both Internal and External.

BRYANT



BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



SIMPLICITY

The National Cold Header was introduced only a few years ago.

It is now accepted as the leader of its field.

Extreme simplicity of design is one of the major reasons.

Investigate and you will discover many more.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO

New York

Detroit

Chicago

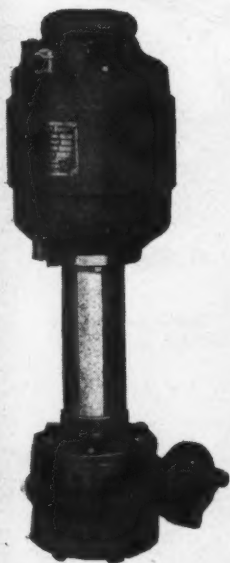
smoother action!

higher precision!

longer life!

DYNAMICALLY BALANCED!

Below: Model 11021, with twin intake and horizontal discharge, equipped with $\frac{1}{4}$ H.P. motor. Other immersed pumps available up to 2 H.P.



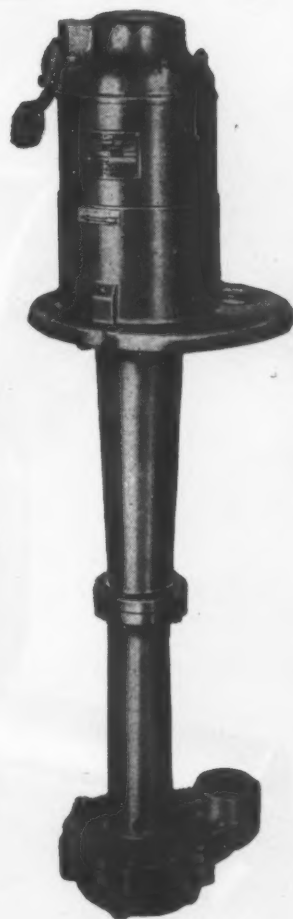
Precision performance in a coolant pump? Sure, it's important! Smooth operation is a necessity, especially on highly accurate machines such as fine grinders, where even a slight amount of vibration can affect precision results.

That is why we now dynamically balance every Gusher Coolant Pump. By means of the dynetric process, all rotating parts are tested and precision-balanced to insure smooth, vibrationless operation. Gusher Coolant Pumps can be used with the finest of equipment with the assurance that their smooth operation will enhance the precision performance of the machines on which they are installed.

Dynamic balancing gives other advantages, too: the absence of vibration means longer trouble-free service. And, because Gusher Coolant Pumps have always incorporated full ball-bearing construction, users have still another guarantee of smooth, dependable operation.

Gusher Coolant Pumps are made better. Their superior construction means true economy wherever they are used. There is a model to meet almost every requirement as to type of intake and discharge, location on machine, and pumping capacity.

The Ruthman Machinery Co.,
1807-1823 Reading Road
Cincinnati 2, Ohio



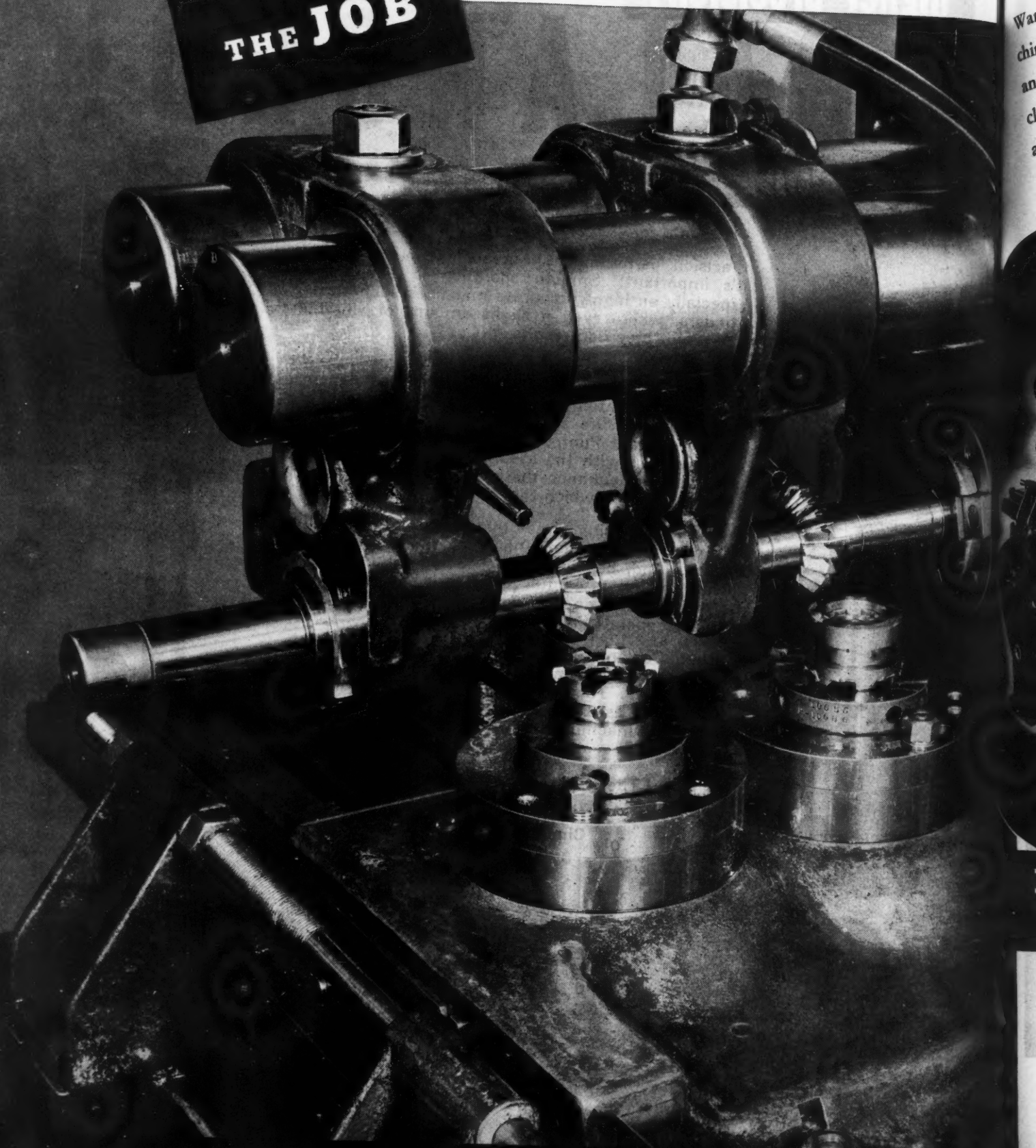
Above: Model HL-15025-B, designed for use with a deep reservoir which may be located below floor level.

THE COOLANT
Heart
FOR A GOOD
MACHINE

GUSHER COOLANT PUMPS

How Low Cost Can Solve Production

THE JOB



Special Fixtures on Problems..

Want to handle a special job on a standard machine? A special fixture can be the money-saving answer! For example, seven teeth in a reverse clutch are rough and finished milled with this automatic indexing fixture mounted on a standard M-24 Simplex Milling Machine. For versa-

tility, the fixture is designed to permit adaptation to various workpieces and similar operations. Developed by Kearney and Trecker Engineering Investigation Service, it is an ideal example of how a low cost attachment can convert a standard machine to specialized production.

ENGINEERING
INVESTIGATION **EIS** SERVICE

THE MACHINE
AND FIXTURE

Engineering Investigation Service includes men of practical engineering experience whose work is that of producing special machines and attachments to overcome various production problems. The experience of these men is amplified by the know-how and facilities of the Kearney & Trecker Corporation, with 48 years of experience in building precision, high speed production machine tools. Specific problems are studied, and the necessary equipment is designed and built, whether it is a special machine or an attachment for a standard machine.

Low initial investment and economical operation are features of this special attachment, mounted on the table of a standard Milwaukee M-24 Simplex milling machine. Automatic cycles of table movement are utilized in the indexing mechanism for the attachment.

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

Milwaukee Machine Tools



Easy-to-understand, well illustrated, the Milling Practice Series of Booklets, are useful reference manuals on milling machine care, operation, and applications. The following are available on request; write on your business letterhead: Book One — Right and Wrong in Milling Practice; Book Two — The Milling Machine and Its Attachments; Methods of Cam Milling.



TESTING MACHINES NEED Calibrating?

Here's a **BALDWIN SERVICE**
to help you . . .

How long since you have had your testing machine calibrated? You'll probably find that a check-up is a good investment.

The Baldwin Calibration Service places at your disposal the help of a specially trained engineering staff, and the largest assortment of Morehouse Proving Rings in the country.

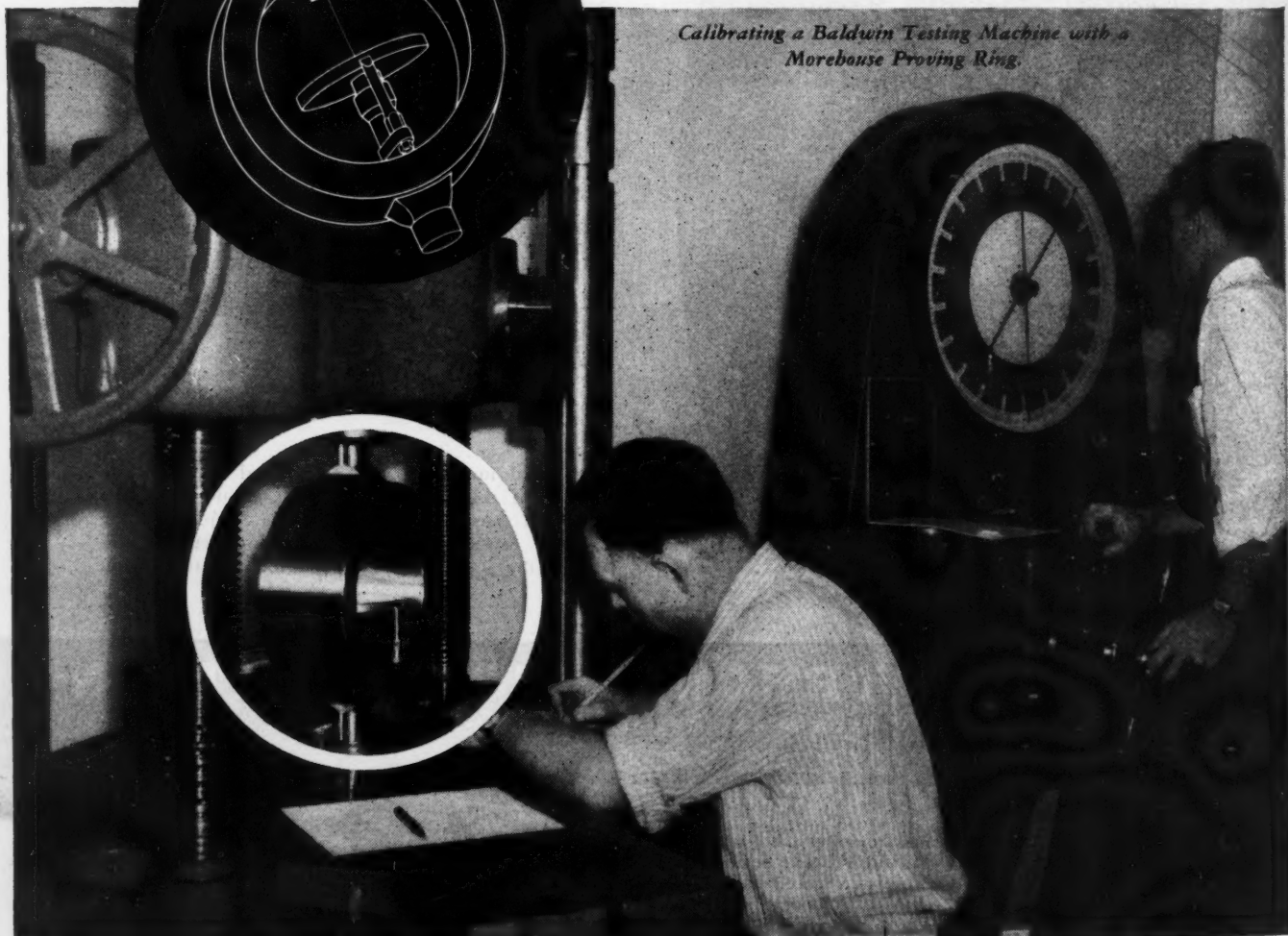
The service can also be used to check scales, measure reactions, and determine loadings in structures and equipment.

Bulletin 186 will give you added information. Write for a copy.

The Baldwin Locomotive Works, Locomotive and Southwark Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, St. Louis, Washington, Boston, San Francisco, Cleveland, Detroit, Pittsburgh, Houston, Birmingham, Norfolk.



BALDWIN
SOUTHWARK
TESTING EQUIPMENT

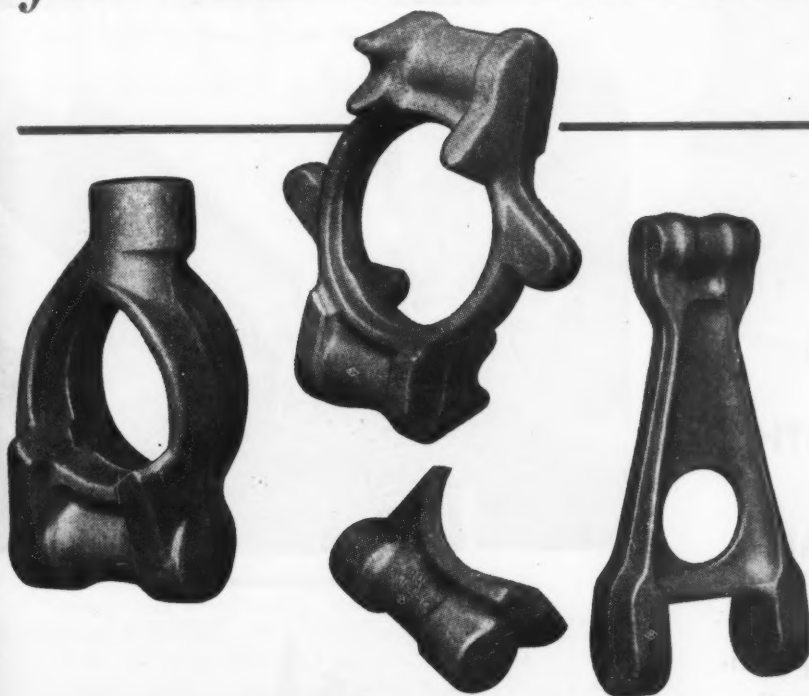


*Calibrating a Baldwin Testing Machine with a
Morehouse Proving Ring.*

Consider the use

of Forgings FIRST

for Your New Machines



Grain Flow—Forgings are made from stock that has been rolled, in which process is initiated the elongated grain structure of the metal, which gives forged parts their superior performance. In the forging process this fibrous structure is intensified and the grain flow advantageously directed with concentration (toughness) at points of greatest shock and strain.

Strength—Forgings provide metals at their ultimate strength and toughness. For centuries, forgings have been universally employed for parts subjected to tensional and torsional stresses. No later day method of producing metal parts has equalled forgings in this respect. As forgings are metal in an intensely compressed state, they are likewise highly resistant to compression and impact stresses.

Machineability—With the close tolerances obtainable in present forging practices, supplemented by modern methods of cleaning the parts after forming, forgings generally require less time to machine and finish, because there is less metal to remove. This results in reduced machining and tool costs. Additionally, as the direction of the grain flow is known, machining operations are facilitated.

Savings in Weight and Metal—In many modern machines, weight reduction is an important advantage. The forging process produces maximum strength, permitting the use of thinner metal sections, resulting in parts of less weight, with corresponding saving of metal. Valuable space may also be saved. With this weight saving applied to a number of parts, the weight of an entire machine may be substantially reduced.

Fatigue Resistance—The service life of machine and equipment parts, especially those subjected to repeated stresses in continuous service, is largely measured by their fatigue resistance. Forgings embody the highest obtainable fatigue resistance. Every step in the forging process, including modern heat treatment, adds something to the useful life of the part. Too, forging always enhances the safety factor.

Kropp Forge—the “world’s largest job forging shop”—offers a complete engineering and production service on flat die, drop and upset forgings of steel or non-ferrous metals, including, where desired, heat treating and rough or finished machining.

Forgings can be delivered promptly—don’t wait for parts of other materials. When you need flat die, drop or upset forgings, call the nearest Kropp engineering representative. He is shop-trained and can give you practical help on your forging requirements. If you prefer, send your blueprints direct for quotation.

Engineering Representatives in Atlanta, Birmingham, Buffalo, Cedar Rapids, Cleveland, Dallas, Detroit, Houston, Indianapolis, Los Angeles, Milwaukee, New York, Portland, Rockford, St. Louis, St. Paul, San Francisco, Seattle, South Bend, Tulsa. Canada: Montreal, Toronto, Vancouver, Winnipeg.

KROPP FORGE COMPANY

5301 W. Roosevelt Road

Chicago 50, Illinois

KROPP

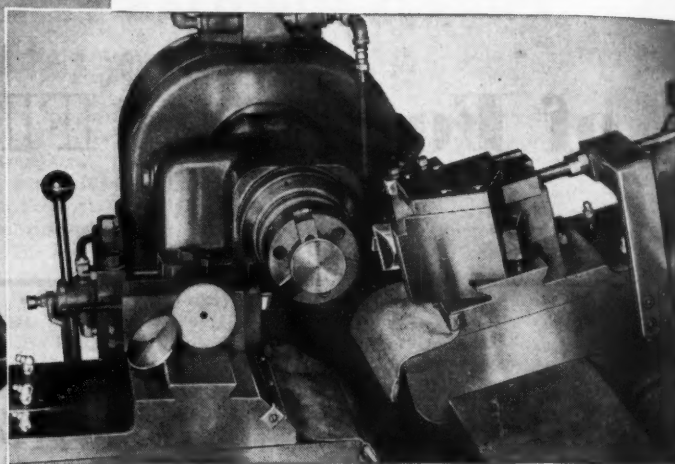
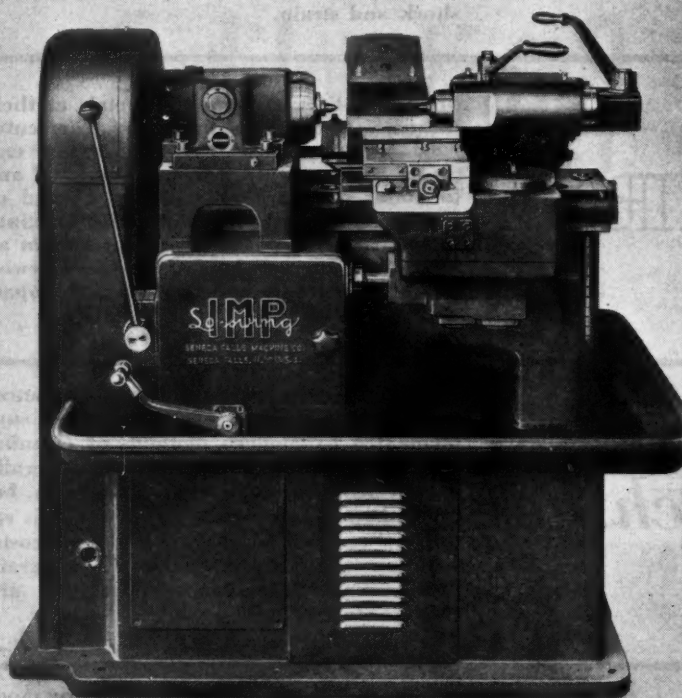


FORGINGS TO YOUR SPECIFICATIONS

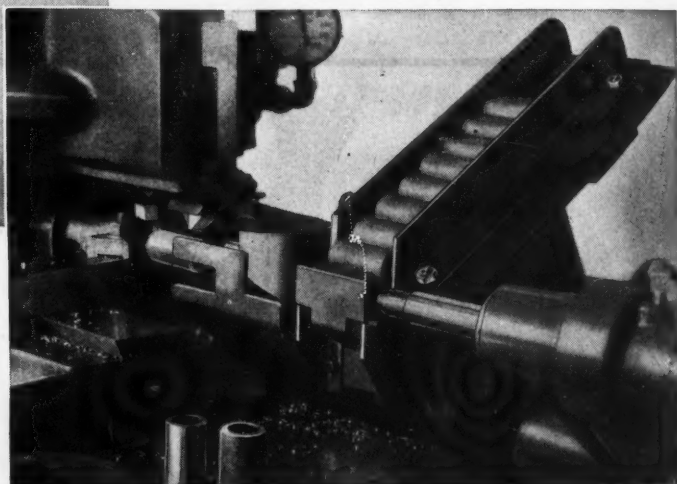
MACHINERY, June, 1946—131

MACHINE OF THE MONTH

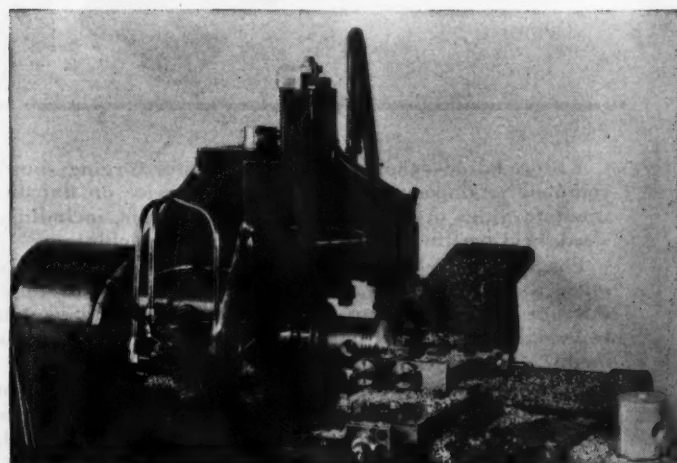
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



IMP with Back-Squaring Attachment



IMP with Automatic Loader



IMP with Back-Squaring Attachment and Third Slide

Lo-swing IMP A VERSATILE AUTOMATIC LATHE FOR SMALL WORK DEMANDING HIGH SPEEDS AND EXTREME ACCURACY

● The Lo-swing IMP Lathe lends itself to practically unlimited tooling possibilities. Illustration above shows a standard machine. The close-up views show three typical applications of standard and special attachments to the base machine which have resulted in increased production and lowered costs.

If you have a turning job requiring high speeds, fine finishes and extreme accuracy, write for IMP Bulletin N-42.

SENECA FALLS MACHINE CO.
Seneca Falls, N. Y.

LATHE NEWS from SENECA FALLS

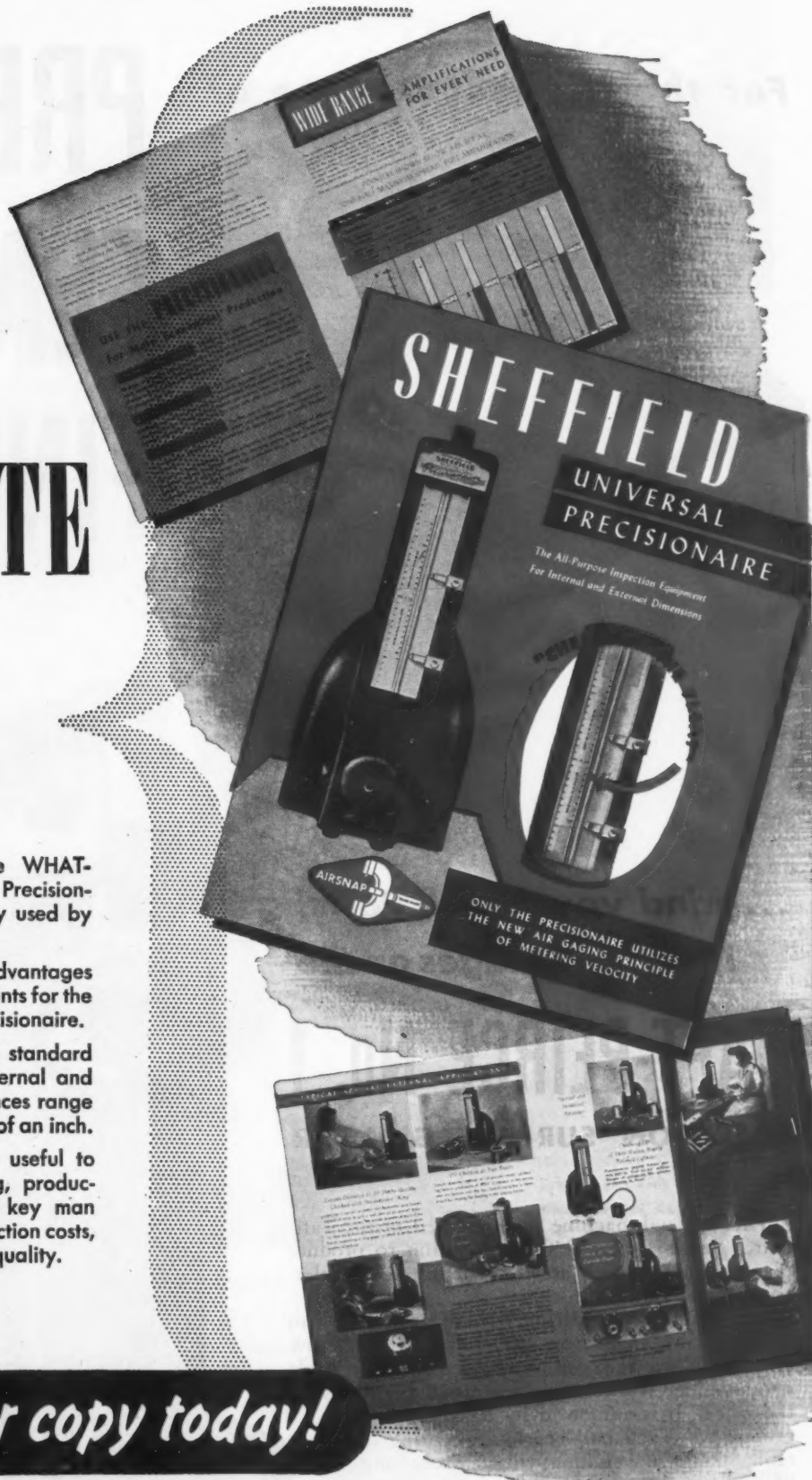
COMPLETE TEXT ON AIR GAGING

This 32-page book presents the WHAT-WHEN-WHY-HOW of the Sheffield Precisionaire—the air gage most universally used by the metal-working industry.

Write for this book. Learn of the advantages of the air flow principle which accounts for the instantaneous accuracy of the Precisionaire.

Look at the many illustrations of standard and special applications, both internal and external dimensions, where tolerances range from "five-tenths to five-millionths" of an inch.

Here is one booklet that will be useful to every tool engineering, designing, production, inspection, and purchasing key man who is interested in reducing production costs, yet maintaining equal or higher quality.



Write for your copy today!

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U. S. A.

MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES



For the Highest Degree of

PRECISION FLATNESS FINISH

**...grind your Small Parts,
Tools, and Gages on the**

TAFT-PEIRCE No. 1 PRECISION SURFACE GRINDER

This unusual machine was designed in the Taft-Peirce Small Tool and Gage Division to produce plane surfaces which are flat within closer tolerances than ever before.

It is unique in its tilting wheelhead, which can be set to any angle from horizontal to 30° below center, making it possible to grind difficult angle and shoulder work with the dressed periphery of the wheel. It is unique in its hardened and ground ways and ball bearing mounting of table, saddle, and column, which assure long life and effortless operation. And it is unique in the high degree of precision, flatness, and finish of the work which it produces.

Through these and other features, the Taft-Peirce No. 1 Precision Surface Grinder will extend measurably your present limits of available precision on any work up to 5" x 12" x 12". Immediate delivery from stock. Write for illustrated booklet.

THE TAFT-PEIRCE MFG. CO., WOONSOCKET, R. I.



6

WAYS WALDES

TRUARC RETAINING RINGS

IMPROVED

GENERAL EXCAVATOR'S

FAMOUS "TYPE 10"

GENERAL EXCAVATOR'S TYPE 10 IN ACTION

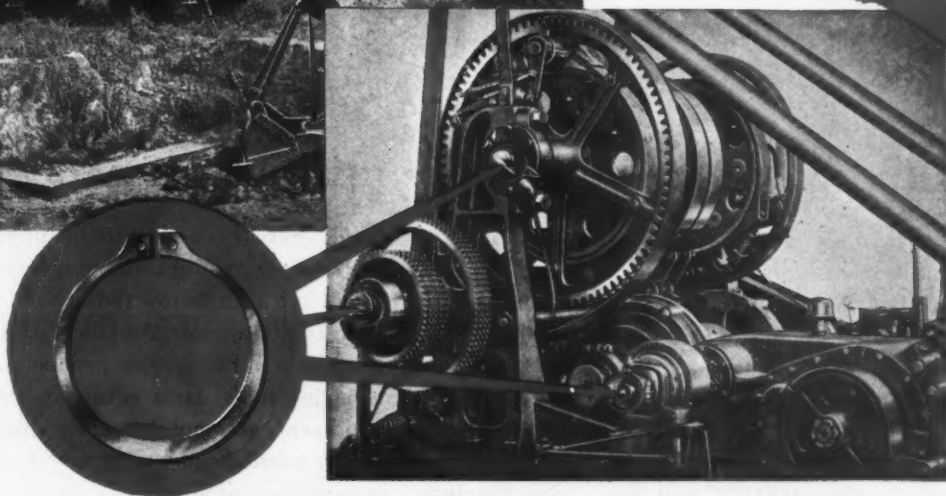
An amazing time saving money saving machine. "Type 10" is precision equipment—a revolutionary development in excavating machinery. It's one of many products—large and small that have the design economy and greater work efficiency of Truarc rings.



GENERAL EXCAVATOR CO. *Bulletin*

Use of Truarc retaining rings on our Type 10, model 105—

1. Gives better integrated construction
2. Simplifies and provides permanently tight assembly on all major shaft assemblies
3. Eliminates bulky lock washers and bolts
4. Speeds production—reduces cost
5. Makes possible greatest design economy with maximum power and efficiency
6. Stands up under the heavy stresses required in our machines

**FREE!**

See how Truarc can improve your products—cut production and maintenance costs. Write today for Truarc booklet showing applications and design sketches. Specify Booklet 23C

NOW YOUR MACHINES CAN HAVE THE DESIGN ECONOMY of retaining rings regardless of load, stress or accuracy involved. Walde's TRUARC high precision retaining rings do the job of nuts, shoulders, collars, pins and snap rings. Yet they allow lighter, more compact units—make assembly and disassembly quicker, easier. TRUARC retaining rings give *better, more dependable retention* because their mathematical precision means perfect circularity—insures an unfailing grip. There's a Truarc ring for every mechanical purpose.

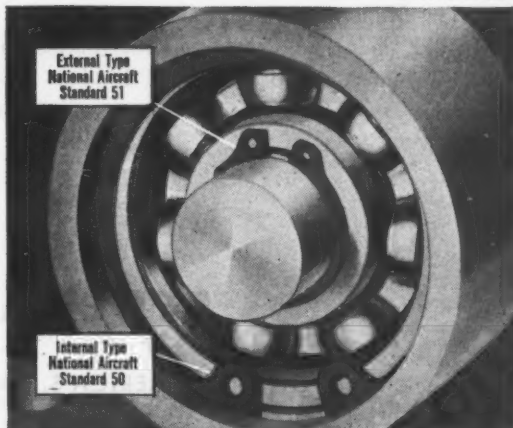
WALDES
TRUARC RETAINING RINGS



WALDES ROHINOOR INC., LONG ISLAND CITY 1, N. Y.

CANADIAN REPRESENTATIVE: PREMO PROGRESS AND ENGINEERING CORPORATION, LTD., 72-74 STAFFORD STREET, TORONTO

U.S. PAT. RE. 10,140





IT TAKES 28 HOURS TO GRIND AND LAP THIS FEDERAL BALL

See this $\frac{1}{4}$ " ball? Twenty-eight hours of grinding and lapping are required to round out its dimensions before it can take its place in a Federal Ball Bearing assembly.

To you as a bearing user that's important, for *only one* bad ball ruins a bearing's efficiency, impairs the performance of your equipment, interrupts production.

But no bad balls can get by the sensitive "fingers" of Federal's electrically controlled inspection gauges. Each ball must be uniformly spherical within .000025" and the variation in diameter in any bearing is not more than .00005". Made of through-hardened chromium alloy steel, each is crush-tested for load-bearing strength, micro-tested to reveal hidden pits or scratches and polished to its lustrous superfinish.

So it goes through every Federal manufacturing step. More than 100 individual production, inspection and cleaning operations go into a single-row radial ball bearing. *Every fourth operator is an inspector.* Add them up and you have *positive* precision performance on production lines everywhere...in machine tools, farm equipment, electric motors, marine equipment, automobiles and airplanes.

That's why, *wherever tolerances are tight*, specify Federal Ball Bearings...in any range or size.

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, NEW YORK

Makers of Fine Ball Bearings

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower-26 • Cleveland: 402 Swetland Building-15
Chicago: 8 S. Michigan Ave.-3 • Los Angeles: 5410 Wilshire Blvd.-36



FEDERAL BALL BEARINGS

ONE OF AMERICA'S FOUR LEADING BALL BEARING MANUFACTURERS

H·P·M *Hydraulics*

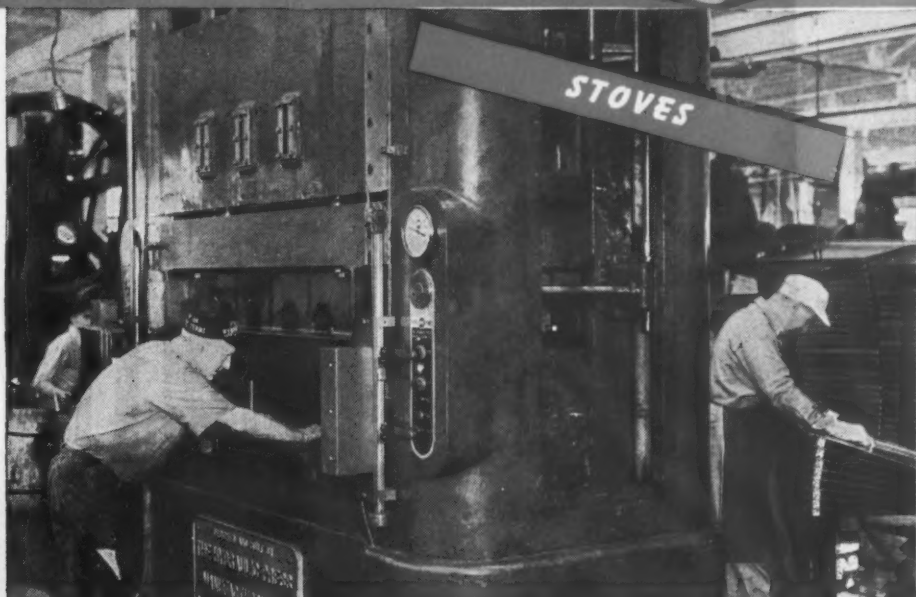
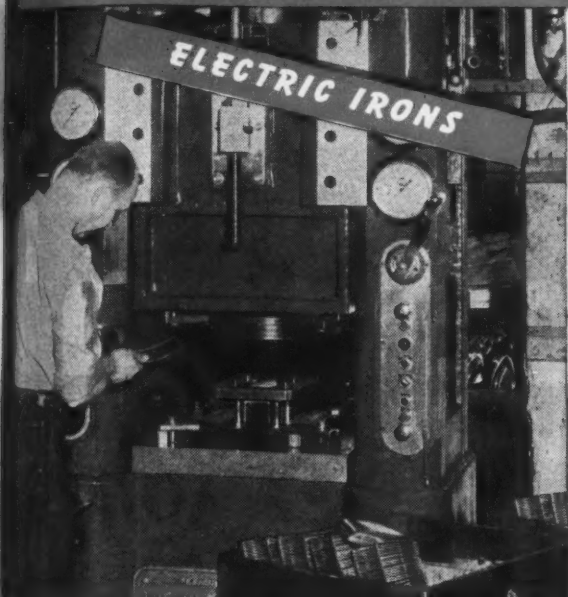
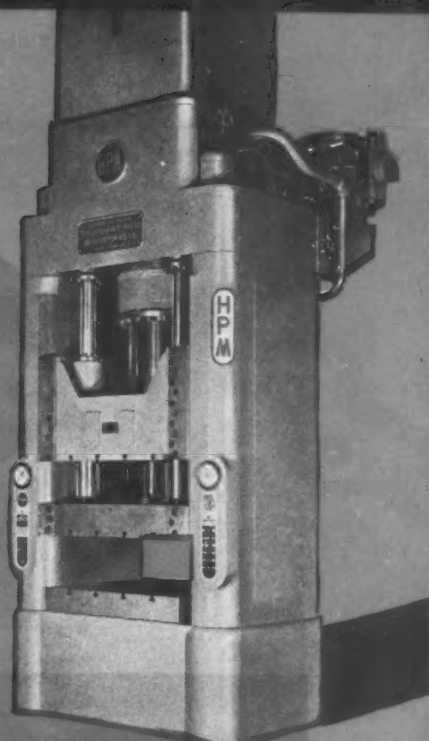
LOWER PRODUCTION COSTS OF HOUSEHOLD APPLIANCES!

Appliance manufacturers who are using H-P-M FASTRAVERSE deep sheet metal drawing presses are obtaining the following cost saving results . . . deeper draws, fewer rejects, less maintenance and a constant high production output. It is an undisputed fact that the hydraulic press is the ideal production tool for drawing sheet metal. When choosing your hydraulic press, ask yourself these questions: Are you buying the most modern self-contained type? Is the press universal, and therefore adaptable to numerous forming and drawing operations? Are the hydraulic components — pumps, valves and controls manufactured by the press builder, thus guaranteeing you undivided responsibility?

When you install H-P-M presses, you gain all of these advantages plus sixty-nine years of specialized hydraulic press experience. Call in an H-P-M engineer to study your particular metal working problem.

THE HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, U.S.A.

BRANCH OFFICES IN NEW YORK, PHILADELPHIA, CLEVELAND, CINCINNATI, DETROIT, AND CHICAGO
REPRESENTATIVES IN OTHER PRINCIPAL CITIES



All Hydraulic-Self Contained
FASTRAVERSE PRESSES
FOR SHEET METAL DRAWING

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1887



**J & H Retraction
Motor Unit**



**J & H
Ball Bearing**

What's in a Name



**J & H Aircraft
Generators**



**J & H Fractional
Horsepower Electric Motors**

J & H Electronic Gages



J & H Inverters



"Precision" is the new word that has been added to our logotype, but *Precision* is not new on our production lines. Our new name had its origin in these production lines where *skill in quantity and precision in volume* set brand new standards for the manufacture of high precision production parts.

Yes, the word "Precision" is now in our name. "Precision" is guaranteed by the skilled Jack & Heintz associates on our production lines. And you'll find precision performance in all of these Jack & Heintz products...built precisely for the aircraft, automotive, machine tool, home appliance, marine, farm equipment and transportation industries.

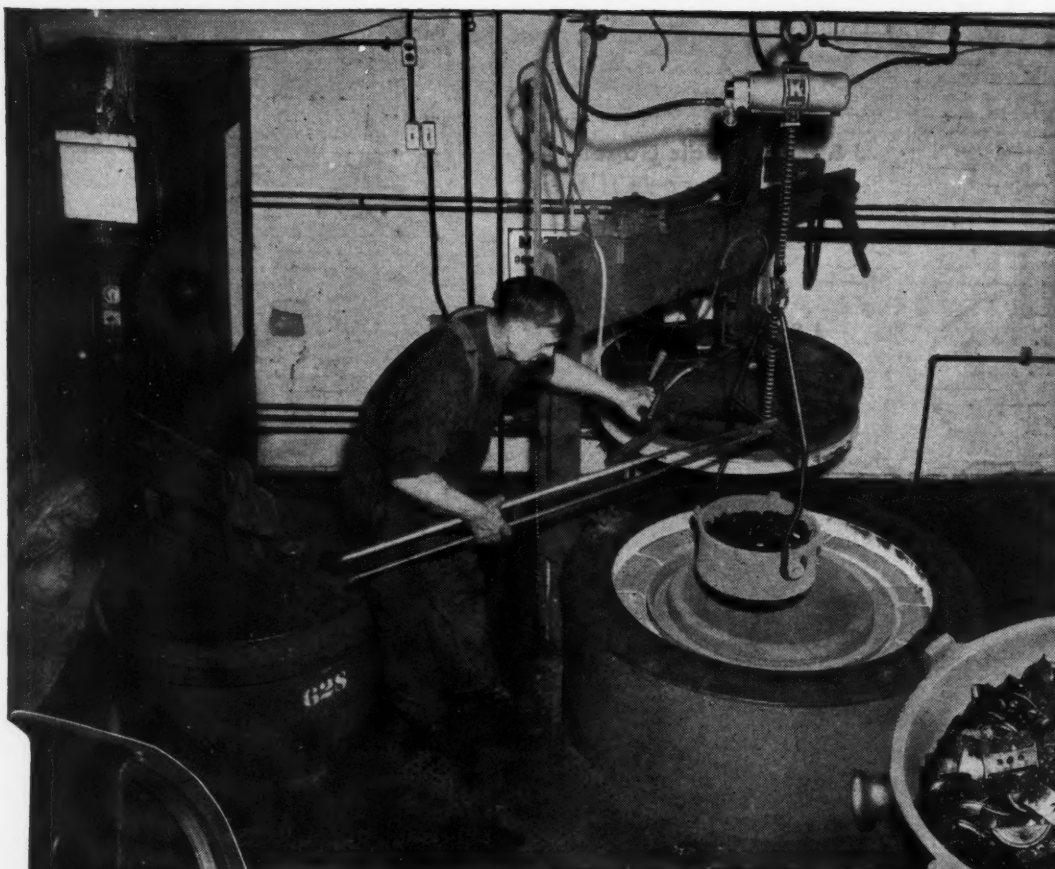
J & H Engines



**J & H
Aircraft Starters**

Jack & Heintz
PRECISION INDUSTRIES INC.
JAHCO

Cleveland 1, Ohio



Tray loaded for Homocarb. In this furnace a load of unusual size and density can be cyanided.

Keller Air Hoist, made by Keller Tool Co., Grand Haven, Mich., helps to gas-cyanide one of its own parts, as it lowers a load into Homocarb Furnace.



Finished part of hoist.

GAS CYANIDE BY THE SURE HOMOCARB METHOD—AND SAVE!

After experience with several forms of heat-treatment, Keller Tool Co. adopted the Homocarb method of gas cyaniding for such small parts as the Brake Wheel Side Block shown above.

Keller makes the parts from $2\frac{1}{2}$ " round No. C-1118 steel. Flanges $\frac{1}{8}$ " wide and $\frac{5}{32}$ " deep are on both faces. Holes run at right angles through the thickness of the part.

The quality of the Homocarb method of heat-treatment is reflected in the fact that no finish grinding of parts is necessary, though tolerances are close. Because gas is the cyaniding medium, there is no loss by carry-over of medium from furnace to quench. Micromax temperature regulation, and the unique Homocarb circulation of gas, produce a cyanide case which is accurately controlled both for structure and thickness.

The oil quench, which the method makes possible, minimizes distortion and gives a uniform file-hard surface throughout a load whose critical size is large. The gas cyaniding contributes also to the safety and convenience of workers.

We'll be glad to send literature on request; or an L&N engineer will call, if you prefer.



LEEDS & NORTHRUP COMPANY, 4921 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

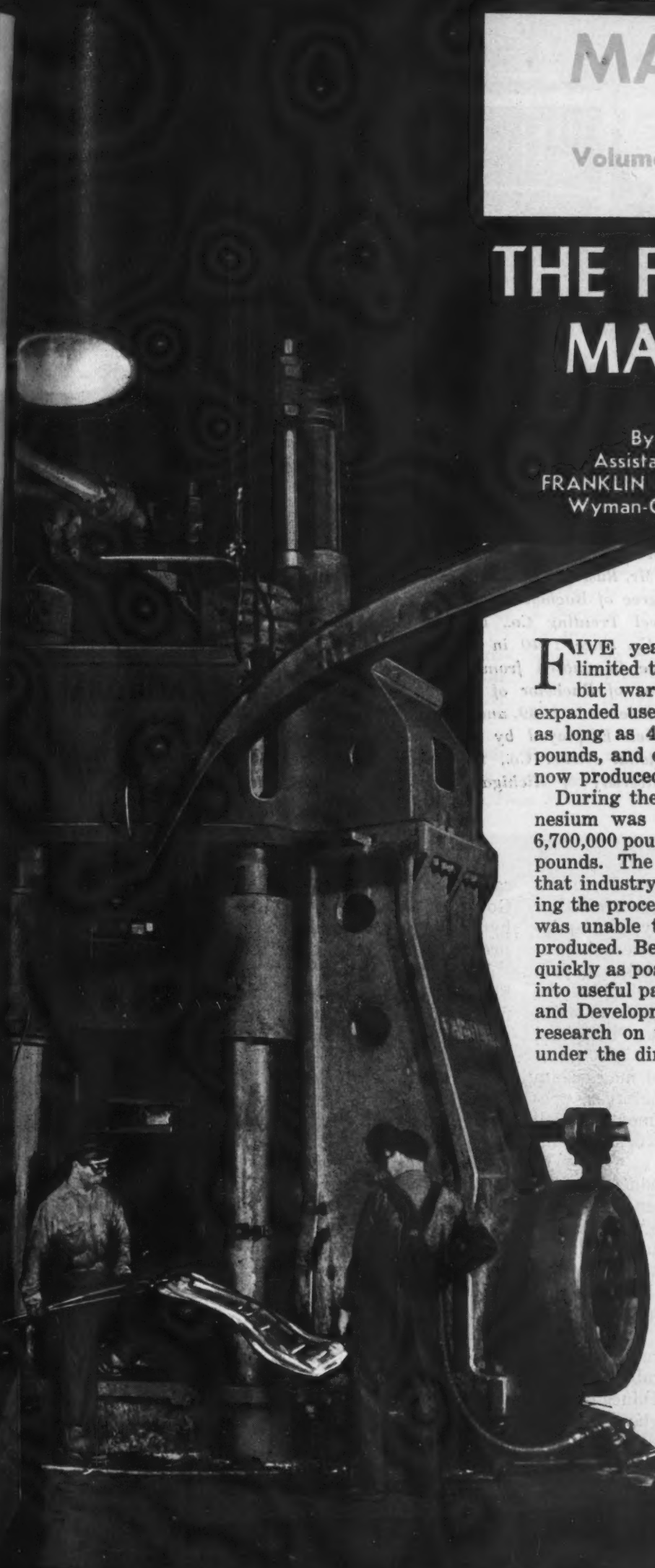
Jrl. Ad T-620(22)



THE FORGING OF MAGNESIUM

By ARNOLD L. RUSTAY

Assistant Chief Metallurgist, and
FRANKLIN B. ROTE, Research Metallurgist
Wyman-Gordon Co., Worcester, Mass.

A large, dark industrial forging press dominates the left side of the page. Two workers in dark clothing and caps are visible in the lower left, standing near the base of the machine. The machine has a large, curved arm and a vertical column. The background is dark and industrial.

FIVE years ago, magnesium forgings were limited to relatively small and simple shapes, but war demands brought about a greatly expanded use of this light-weight metal. Forgings as long as 4 feet, weighing as much as 18 1/2 pounds, and of comparatively intricate design, are now produced.

During the war period, the production of magnesium was increased from the 1939 output of 6,700,000 pounds to an annual output of 366,500,000 pounds. The increase in production was so rapid that industry, with its limited knowledge concerning the processing of this metal and its properties, was unable to use magnesium as fast as it was produced. Because it was desirable to determine as quickly as possible how to manufacture magnesium into useful parts, the Office of Production Research and Development undertook the job of instituting research on the various manufacturing processes under the direction of Dr. A. F. Greaves-Walker.

To the Wyman-Gordon Co. was assigned the research on forging, and in the plant of this concern, extensive experiments were conducted from which a great deal of valuable information was obtained. The Wyman-Gordon project was carried out by the authors of this article.

It was generally believed by those engaged in the production of magnesium forgings that all forging of these light alloys must be done in hydraulic or slow-moving mechanical presses. This practice limited the size of forging that could be made, since large presses



The Authors of This Article, Arnold L. Rustay (Left) and Franklin B. Rote (Right), Have a Wide Background in the Engineering and Metallurgical Fields. Mr. Rustay Graduated from the University of Chicago in 1935 with the Degree of Bachelor of Science. He has been Employed by the Lindberg Steel Treating Co., Bliss & Laughlin, Inc., and by the Wyman-Gordon Co. since 1940 in the Capacity of Assistant Chief Metallurgist. Mr. Rote Graduated from the University of Michigan in 1938 with the Degree of Bachelor of Science in Engineering, Earned a Master's Degree in Science in 1939, and a Doctor's Degree in Philosophy in 1944. He has been Employed by the Development and Research Laboratory, International Nickel Co., the Department of Engineering Research of the University of Michigan, and the Wyman-Gordon Co.

were not available. While large drop-hammers could have been utilized, it was not known whether magnesium could be forged with that type of equipment. A considerable amount of research was therefore conducted to determine whether a procedure could be developed that would combine the use of available light hydraulic presses with mechanical presses and drop-hammers. The actual forging of large numbers of magnesium parts demonstrated that all of the standard magnesium alloys can be finish-forged under a hammer, provided the preliminary metal movement, which occurs in the blocking operation, is first accomplished in a hydraulic press.

Relatively large forgings can be produced in this manner. Magnesium forgings have been made with practically all possible types of grain flow during forging and with no particular difficulty in handling any one type of forging. Certain jobs require considerably more care than others, but with the proper equipment and forging technique, magnesium forgings can be successfully produced in practically all cases. If larger hydraulic presses are available, it is undoubtedly preferable to carry out both blocking and finishing in machines of that type, but the hydraulic press must be of heavy

capacity. It is for this reason that the Wyman-Gordon Co. is at present installing an 18,000-ton hydraulic press, which is believed to be the largest press of this type in the United States.

With the combination method—that is, first blocking the stock in a hydraulic press and then finishing under a hammer—forgings have been successfully produced from cast “multiples” or blanks of AZ31X, AZ61X, and AZ80X alloys. (See Data Sheet on page 245 of this number of MACHINERY for corresponding symbols of the American Society for Testing Materials, the Dow Chemical Co., and the American Magnesium Corporation for the magnesium alloys mentioned in this article, and also for all other standard magnesium alloys.)

A large number of forgings involving light and heavy sections and many different types of metal flow were produced by the combination method. A number of these forgings are shown in Fig. 1. The largest, in the center, is 15 1/4 inches long and weighs 3 3/4 pounds. The cylindrical part at the upper left is 8 inches long and weighs 10 1/4 pounds. The intricacy of the designs that can be forged is exemplified by the impeller seen at the right center.

In Fig. 2 is shown a cargo-hoist forging which measures 51 inches long and weighs 17 1/2 pounds. This forging was produced in a 14,000-ton hydraulic press in three steps from an extruded bar upset to the outline seen at the top in the illustration. The forgings were trimmed by band-sawing and machining, a procedure that is often more economical for this type of operation than the use of a trimmer die, especially for small runs of rather large forgings.

Another excellent example of the possibilities of magnesium forging is the aircraft brake carrier illustrated in Figs. 3 and 4. This part is approximately 15 1/2 inches maximum diameter and was produced from 6-inch round bars. Four forging operations were required—upsetting, blocking, prefinishing, and finishing. Since this was a large production run, the forgings were trimmed in a die immediately after the finishing operation. The parting line of the die members extended around the bottom edge of the flange as it appears in Fig. 3. The over-all height of the forging was 5 1/2 inches.

Most of the forgings seen in Fig. 1 were produced in dies that had been made for aluminum forgings, and except that the handling procedure

had to be varied, little difficulty was encountered in using the same dies for magnesium. Forgings designed with draft angles of from 7 to 10 degrees can be made with ease from aluminum alloys, but when magnesium alloys are press-forged in the same dies, difficulty is sometimes encountered due to laps being formed at the top of high ribs as a result of the tendency of magnesium to flow more readily on the surface than in the interior of a part. This results in defects which may extend as much as 1/4 inch into a forging having an extremely high section. Smaller draft angles (of from 1 to 3 degrees) will relieve or completely eliminate this difficulty. When a forging is to be blocked in a press and finished under a hammer, the use of a generous draft angle presents fewer problems than when the forging is to be blocked and finished in press operations only.

Draft angles of from 7 to 10 degrees may be used in finishing dies designed for use in a steam or board drop-hammer, but draft angles of from 3 to 5 degrees are recommended if the forgings are to be produced entirely in presses. Fillets and radii should be considerably more generous for magnesium forging than is necessary in handling aluminum alloys, so as to prevent surface lapping.

Fig. 1. Variety of Magnesium Forgings that have been Produced by the Combination Method—that is, First Blocking in a Hydraulic Press and Then Finishing under a Hammer



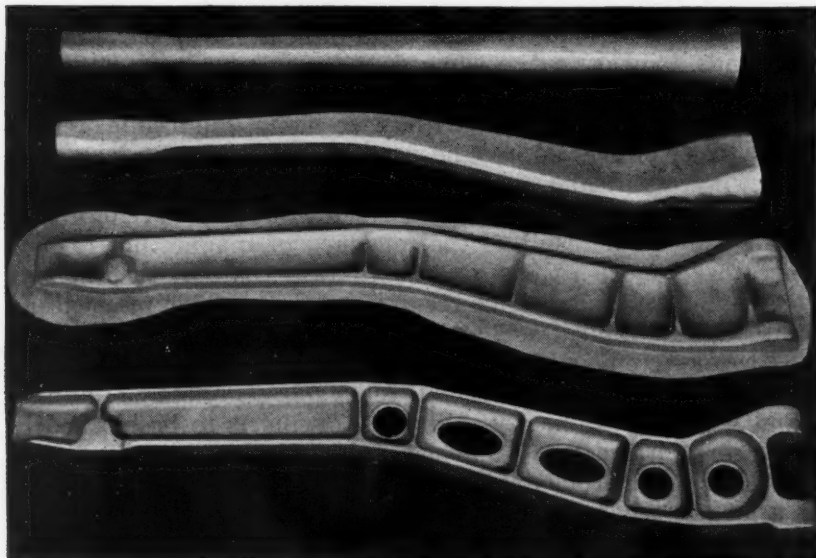


Fig. 2. Four Steps in the Production of Cargo-hoist Forgings having a Length of over 50 Inches and a Weight of Approximately 17 1/2 Pounds. This Forging was Produced from AZ80X Magnesium Alloy in a 14,000-ton Hydraulic Press. The Pressure Required to Fill the Blocker Die was 11,000 Tons, and that Required to Fill the Finishing Die, 12,900 Tons

Blocker dies for large forgings having high rib or flange sections should be designed so that the metal for these high sections is blocked inside its final location. This minimizes or prevents run-outs into the gutter of the finishing die, and consequent under-filling, which might result from the tendency for magnesium alloys to flow outward rather than upward during forging. Blocker dies should also be designed with provision for flashing in the blocking operation and with only enough stock in the

forging to fill the finish die. The dies should be completely closed in the blocking operation, so that there will be no excess stock to be formed into flash during finish forging. This prevents the shearing of high ribs during finish forging.

Most parts that can be made as aluminum forgings can also be produced as magnesium forgings, provided sufficient press capacity is available to effect the initial metal movement. The forgings can then be finished in a press or hammer. In dies

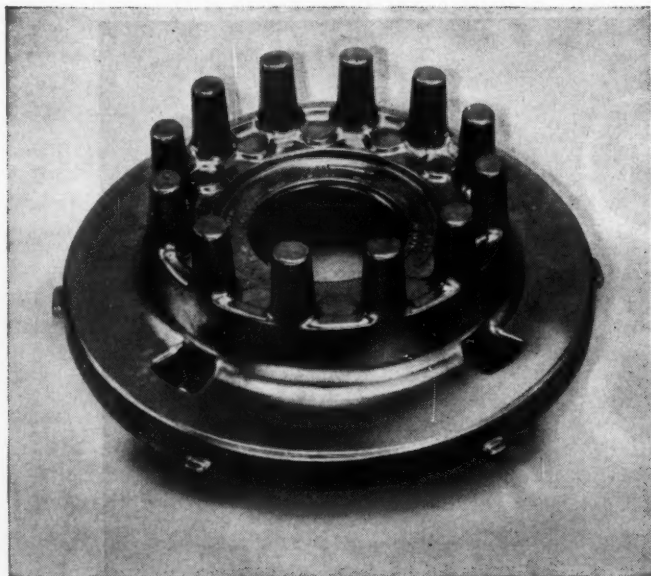


Fig. 3. Aircraft Brake Carrier, 15 1/2 Inches in Diameter by 5 1/2 Inches in Height, having a Weight of Only 17 1/2 Pounds, which was Forged from Magnesium in Four Operations, Consisting of Upsetting, Blocking, Prefinishing, and Finishing

Fig. 4. Under Side of the Aircraft Brake Carrier in Fig. 3. This Forging was Finished with the Vertical Posts or "Candles" Seen in Fig. 3 Produced in Cavities in the Bottom Die Member. All of the Operations were Performed in a Hydraulic Press

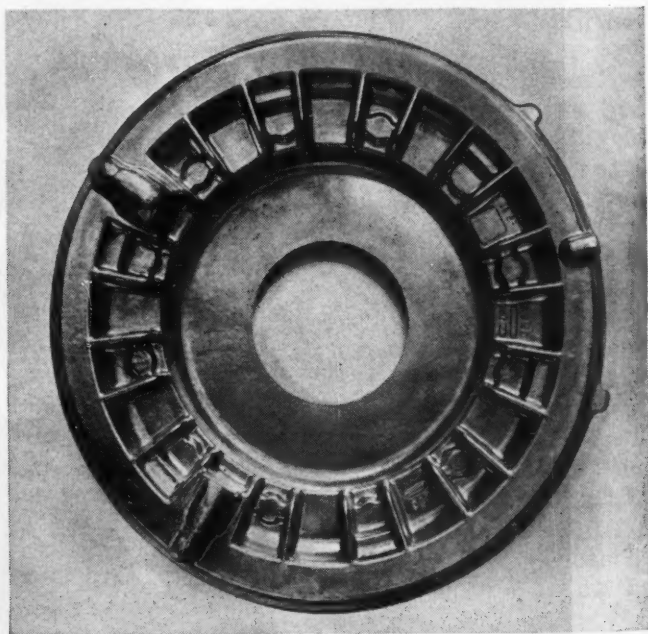
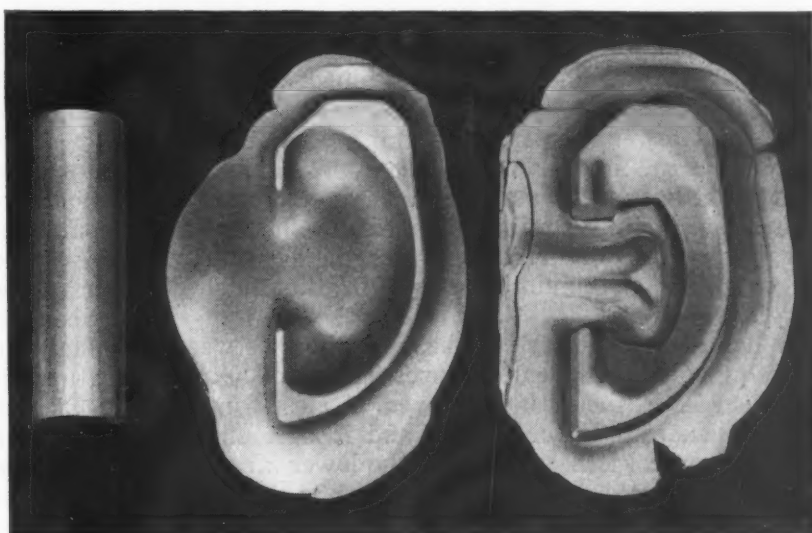


Fig. 5. Magnesium Forging, 6 7/8 by 3 1/4 by 1 1/2 Inches, Weighing One Pound, which was Produced by Blocking under a 700-ton Hydraulic Press and Finishing under a 3000-pound Drop-hammer, from 4-inch Round Extruded Stock. Extreme Metal Movement Occurred in Forging, which Involved Bending Mass of Stock in Order to Produce Relatively Heavy Section on One Side



of proper design, with generous fillets, considerable metal movement, either laterally or longitudinally, can be effected without any danger of internal cracking or surface checking of the work.

Hammer forging of magnesium alloys containing more than 5 per cent aluminum should be approached with caution, although any of the standard press forging alloys may be forged under a hammer, provided the major initial metal movement is accomplished in a press. Under certain conditions, magnesium forgings may be completely forged under a hammer, but the stock must be entirely enclosed, in both blocking and finishing operations, and not subjected to alternate pressure on opposing sides.

The hammer forging alloys—M3, AZ31X, and AT35X—are much easier to handle in hammer operations than the high-strength alloys, AZ61X and AZ80X, although the most consistent success has been achieved by blocking even these alloys in a press.

The most consistent success in producing magnesium forgings free from hot or cold cracks, completely filled, and with highest mechanical

properties has been obtained with a forging temperature of between 700 and 725 degrees F. In this temperature range, all magnesium alloys achieve sufficient ductility to permit working to extreme limits without cracking. Further, the magnesium-aluminum compound in the high-strength alloys may be completely dissolved upon sufficiently prolonged heating in this temperature range. When this complete solution is retained by water quenching after trimming, the maximum benefit from a subsequent aging heat-treatment may be realized.

The preferable blocker die temperature is about 600 degrees F. With the die heated to that temperature, the magnesium blank can be blocked and will yet retain sufficient heat to withstand a subsequent finish-forging operation without danger of cracking. When higher die temperatures are employed, magnesium alloys have a tendency to stick in the dies, unless extremely heavy lubrication is provided. Heavy lubrication is undesirable because of the possibility of under-filling die impressions, and because of the need for expensive cleaning operations prior to shipment of the work. When lower die temperatures are employed, the metal may lose

Fig. 6. The Forging of the Magnesium Part Here Shown, Measuring 7 1/2 Inches by 3 3/4 Inches by 1/2 Inch, Required Extreme Flattening and the Filling of an Unusually Irregular Impression in the Blocking and Finishing Dies. The Part Weighs 6 Ounces



so much heat during blocking that cold cracking is likely to occur in the finishing die.

Finishing dies should be maintained at a temperature of around 400 degrees F., being used at a somewhat lower temperature than blocker dies in order that the magnesium stock may lose a certain amount of heat and thus undergo some strain hardening and definite grain refinement in the finish-forging operation. This enhances the possibility of obtaining maximum strength in the finished forgings.

When it is necessary to reheat forgings between forming operations, temperatures between 600 and 650 degrees F. should be employed. A close control must be exercised over AZ80X and AZ61X alloys, but less control is necessary for the lower strength alloys. Complete forging in one heat is desirable because it permits retention of the finest grain size and maximum mechanical properties in the finished forging. Also, the danger of cracking during the hammer finishing of the high-strength alloys after a reheat is eliminated.

Water quenching of forgings directly from the die prevents recrystallization and grain growth, provided the finish-forging operation is completed at a high temperature, and subsequent aging heat-treatment is facilitated because of the chemical condition of the forging. The time the stock is heated for forging should be varied according to the size and structural condition. Small size stock, for example, is worked considerably during extrusion, and is, therefore, usually very fine-grained and homogeneous, so that only a short heat soak is required. Large size stock, on the other hand, is worked less during the extrusion process, and is, therefore, relatively coarse-grained, and the magnesium-aluminum compound is usually badly

segregated. It must be soaked for a longer period of time to obtain adequate homogenization.

Experience has shown that stock up to 2 inches in diameter should be forged as soon as practicable after it has reached the forging temperature, whereas large stock—6 inches in diameter or larger—should be heated for long periods of time in preparation for forging. The soaking time for large-diameter stock may be as much as sixteen hours at the recommended forging temperature of between 700 and 725 degrees F.

Magnesium forgings should be trimmed at temperatures between 350 and 450 degrees F., especially AZ61X and AZ80X alloys, which are most affected by poor trimming practice. If trimming operations are performed when magnesium forgings are too hot, the metal is likely to smear (that is, fill in between the trimmer punch and die), undesirable sharp fins are produced, and the trimming operation cuts into the metal proper. On the other hand, if trimming is performed when the forgings have cooled to too low a temperature, the metal is likely to crack and tear.

As already pointed out, the radii of all fillets should be made as generous as possible, both in blocker and finishing dies, in order to insure easy flow of the metal. Wherever the stock is confined by small fillets, the surface metal of the forging will tend to flow at the expense of the center metal, and thus produce small laps or cold shuts on the sides or top of high ribs. The minimum fillet radius should be 1/8 inch, regardless of the size of any section, but larger radii should be specified whenever possible.

Forgings of comparatively high strength can be produced from cast stock, provided the quality of the castings is high and the amount of work to

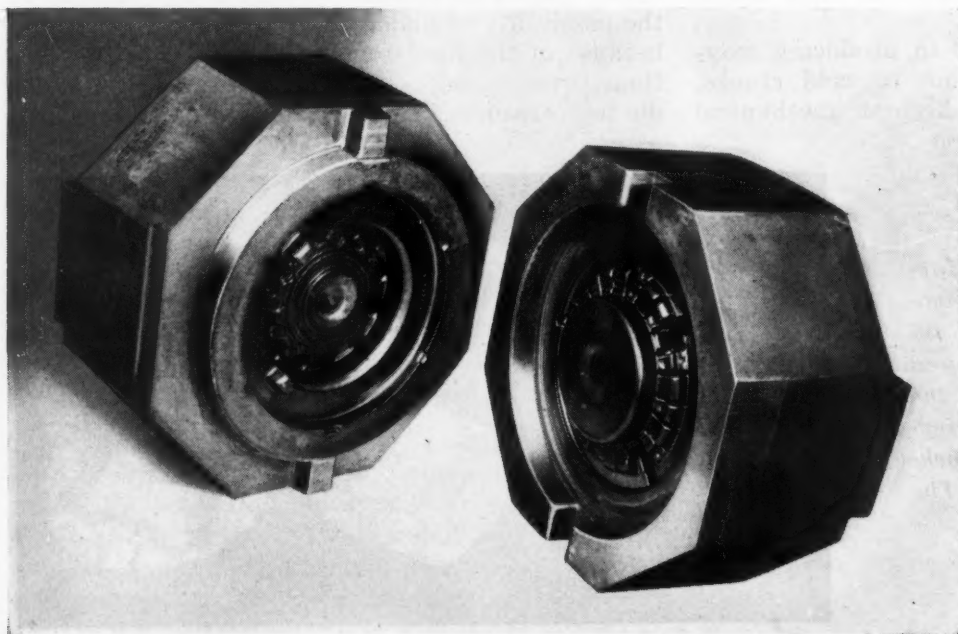
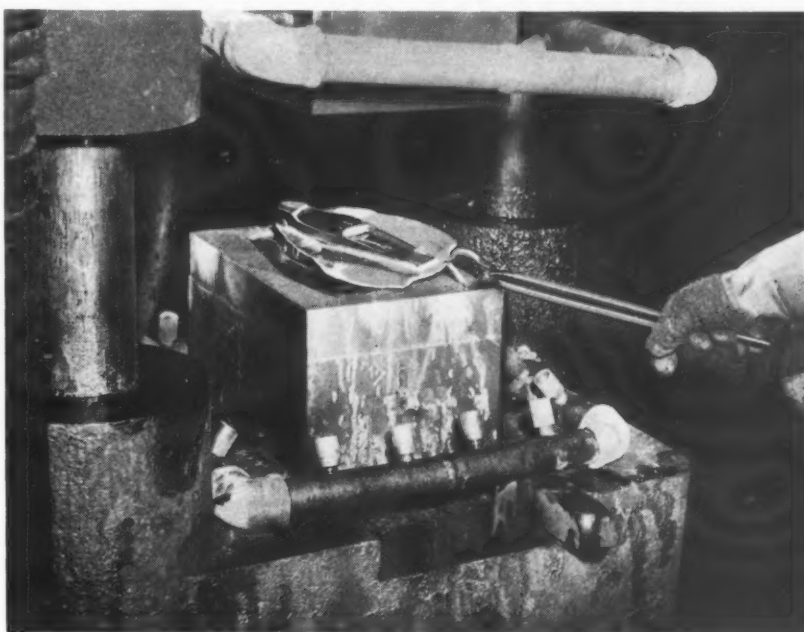


Fig. 7. Finish Dies for a Magnesium Aircraft Brake Member. The Dies are Sunk in 26-inch Octagonal Blocks. The Blocker Dies for the Same Forging were of Similar Construction

Fig. 8. Dies Employed in Magnesium Forging must be Maintained at a Temperature of About 600 Degrees F. in the Case of Blocker Dies and 400 Degrees F. in the Case of Finishing Dies. Dies Used in the Wyman-Gordon Plant are Provided with Manifolds, as Shown, for Directing Gas Flames All around the Dies as Close as Possible to the Forging Area



which the castings are subjected in forging is sufficient to effect considerable grain refinement. If cast stock is handled carefully during heating, it can be forged in the same manner as extruded stock. Cast stock must be completely confined during forging, in order to prevent cracking at the surface and beneath the surface. Scalped castings are not subject to such rigid limitations, but also require careful handling.

Experiments were conducted on standard magnesium alloys which had been modified by the addition of bismuth to increase resistance to stress corrosion. These modified alloys have shown adequate forgeability. Some difficulty was encountered, which was believed to be due to surface checks and coarse grains in the bar stock. A 4 to 6 per cent cerium alloy, developed for service under high temperatures, can be forged as readily as any of the standard forging alloys. This special alloy has been forged at temperatures as high as 825 degrees F.

In instances where the maximum tensile and compressive strength are required in forgings of the AZ80X alloy, the forgings should be aged at a temperature of from 325 to 375 degrees F. A higher temperature permits excessively large precipitated particles in the structure, and does not result in the desired strength, while lower temperatures necessitate an excessively long aging period. Aging for sixteen hours at 325 degrees F., eight hours at 350 degrees F., or six hours at 375 degrees F. seems to produce almost maximum tensile, yield, and ultimate strengths and considerably greater ductility than is obtained with full aging.

The tensile and compressive strengths of magnesium forgings vary with the size of stock and the amount of work required in producing the

forging, and upon the alloy used. Tensile strengths ranging from 37,000 to 57,000 pounds per square inch were obtained in the Wyman-Gordon research; yield strengths ranged from 26,000 to 46,000 pounds per square inch; and compressive strengths from 11,000 to 33,000 pounds per square inch. The hardness ranged from 59 to 96 Brinell. In planning forging set-ups, however, it should be remembered that forgings made from large size stock which does not receive much work during forging may not meet the alloy specifications so far as strength is concerned. On the other hand, experience has shown that even 8-inch round extruded stock, if subjected to sufficient work after a proper homogenization treatment in preparation for forging, may exceed strength specifications.

Experience has indicated the need of a close laboratory control of the raw material in order to insure the highest properties in the finished forgings. This control must be exercised both over the material itself and the various operations, including finish-coating.

Most forgings are subjected to machining and assembly operations after they leave the forge shop, but nevertheless, a coating should be applied in order to protect the magnesium during shipment of the forging to a customer. The Dow Chemical Co. has developed a number of protective coating treatments for this purpose. The most widely used one consists of immersing the forgings in an acid dichromate solution. It is more difficult to obtain a satisfactory coating on magnesium forgings than on die-castings or sand castings of the same metal, due to the fact that considerable die lubricant is necessary to produce satisfactory magnesium forgings under reasonable power requirements. When attempts are made to remove graphite by acid

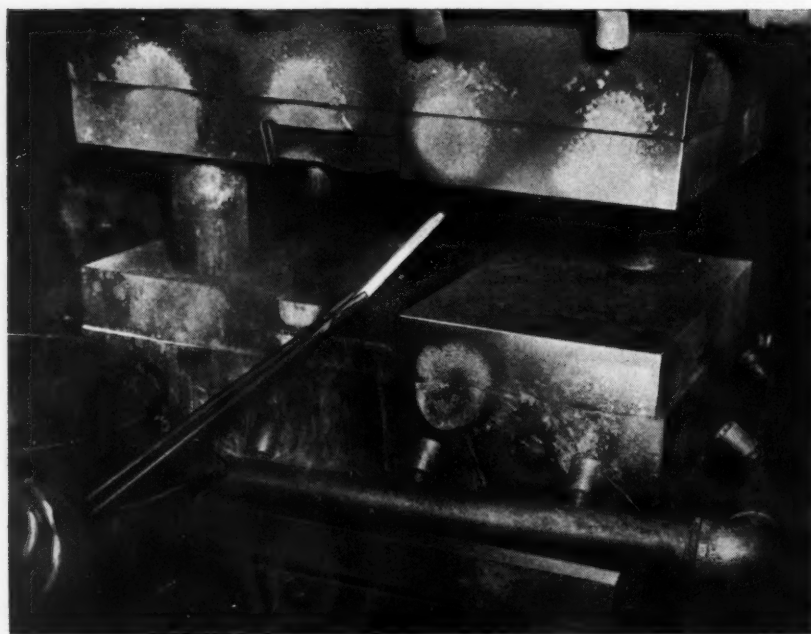


Fig. 9. Another View of a Forging Die, Showing a Hot Magnesium Bar being Held in Place, Ready for the Forging of Comparatively Small Parts. The Extruded Magnesium Bar is Heated to 725 Degrees F. for the Operation

pickling, severe surface pitting occurs, due to galvanic corrosion in the areas surrounding the graphite particles. The only successful method for removing all graphite and included dirt from forgings is sand-blasting. A smooth, clean surface can be obtained with No. 120 Alundum grit under a pressure of 90 to 100 pounds per square inch.

After sand-blasting, the forgings are immersed from five to ten seconds in a dip containing 8 per cent nitric acid and 2 per cent sulphuric acid. This dip reacts vigorously, completes the removal of all foreign material, and smooths the surface. The forgings are then rinsed and lowered into a 10 to 20 per cent caustic solution maintained at a temperature of approximately 180 degrees F. They are permitted to remain in this solution for approximately five minutes, so as to remove any sludge or dirt left on the forgings after the acid pickle. The forgings are finally rinsed in a cold water bath to remove the excess caustic and to cool them to room temperature.

The forgings are now ready for the sodium dichromate bath, which contains on the basis of 1 gallon of solution, 1.5 pounds of sodium dichromate; 1.5 pints of nitric acid; and 0.2 pound of Epsom salts. The solution should be controlled so that the sodium dichromate content does not drop lower than 1 pound per gallon of solution, nor the nitric acid below 1 pint per gallon. The time the forgings should remain in this dip varies

somewhat with the particular alloy, but generally ranges between ten and thirty seconds.

After the dichromate dip, the forgings should be left in the air from three to eight seconds to permit the solution on the surface of the forgings to become syrupy and to set the coating. They should then be rinsed in cold water to remove the excess dichromate acid solution, and finally dipped in hot water to facilitate drying. The most desirable coating from the standpoint of production and attractiveness has an iridescent, satiny finish. A glossy brass finish is considered undesirable. Care should be taken to avoid staining of forgings during coating by contact with dissimilar materials. If forgings are permitted to come into contact with carbon or iron in either the acid dip or the dichromate dip, serious surface pitting may result. Forgings should be handled with rubber gloves or magnesium-alloy hooks, or in magnesium baskets, depending upon the size and number of the forgings.

The coating obtained on AZ80X forgings in the aged condition is undesirable because of its rough, powdery nature, which is not conducive to paint adherence and is unpleasant to handle, as the powder rubs off constantly. To eliminate this condition, forgings of the alloy mentioned should be coated before aging. The forgings should be handled carefully after coating to prevent contact with grease or fingerprints which will become baked into the coating during the aging treatment.

29.
b

The Hydraulic Circuit in Bending Machines

By E. J. DeWITT, Vice-President, and
HARRY S. NACHMAN, Engineer
Wallace Supplies Mfg. Co., Chicago, Ill.

Principal Considerations in the Design and Application of Hydraulic Circuits Used in Machines for Bending Pipe, Tubes, and Other Metal Shapes—Third of a Series of Articles on the Application of Bending Machines

A HYDRAULIC power system is steady and easily controlled. It is flexible and readily installed, self-lubricating, and has relatively few moving parts. The great majority of modern bending machines able to handle material larger than 1-inch diameter pipe, or its equivalent, are hydraulically driven.

The keynote of a good hydraulic system is simplicity of control. The fewer the levers or buttons to push, the better. In a fully hydraulic bending machine, the following movements must be actuated through the circuit: (1) The moving of the mandrel into and out of its bending position; (2) the action of the clamping die in gripping and releasing the material; (3) the action of the pressure die in engaging and releasing the material; and (4) the rotation of the form in both directions.

Each of these movements is actuated directly or indirectly by a piston mounted in a hydraulic cylinder. There is a separate cylinder for the operation of each tool. Almost all cylinders used for the purposes mentioned have oil inlets at both ends, so that the piston may be made to move in either direction. For example, the clamping die will clamp the material when oil is forced into one end of the cylinder, and will unclamp the material when oil is pumped into the other end of the cylinder.

A Typical Circuit for a Bending Machine

A simple diagram of a typical circuit is shown in Fig 1. The circuit is of the closed type, which means that the same oil is used over and over again. When oil is pumped under pressure it becomes heated, and as it is pumped over and over again, it will become so hot that it will eventually break down unless some means is provided for cooling it between each passage to the pump. For this purpose, there is incorporated in each system a large oil storage tank, in which all the oil must remain for some period during each passage through the circuit. In high-speed circuits, an oil cooling tower or heat exchanger is sometimes used.

The pumps, of which there may be one, two, or three in the circuit, are usually driven directly by electric motors. The biggest size of material that is to be bent on a machine determines the pressure at which the oil must be pumped, and the bending speed determines the amount of oil necessary.

Relief Valve Used to Prevent Damage to the Machinery

The pumps, motors, cylinders, tanks, and oil are similar in all circuits. The differences between circuits for various machines are chiefly in the type and arrangement of the valves used. The first valve in a circuit, after the pump, should be a pressure relief valve, so that the pressure in the circuit at any time will be that needed for the work to be done. For instance, the circuit on a machine may be designed to operate at pressures as high as 2000 pounds per square inch. However, the machine may be used for bending a piece of material that is very much lighter than the largest-sized material it has the capacity to bend. For the lighter work, the cylinder that causes the form to rotate, needs, perhaps, a pressure of only 300 pounds per square inch. Then the pressure relief valve reduces the pressure in the circuit, so that it does not exceed 300 pounds per square inch.

There is a corresponding pressure control when work larger than that intended for the machine is put in place to be bent. For the larger piece, the driving cylinder may call for a pressure of 3000 pounds per square inch; that is, 1000 pounds more than that for which the machine is designed. In that case, the pump and motor would be overloaded and the machine would be damaged if there were no pressure relief valve. Thus, it is evident that the pressure relief valve acts as an automatic safety device, being set at such a pressure that the machine cannot be overloaded, and functioning so that the pressure in the circuit will never exceed that for which the valve is set.

In actual operation, the relief valve is in fre-

quent use. When the piston reaches the end of its stroke and can go no farther, the circuit tends to build up an excessive pressure, such as would result in damage to the cylinder or stall the motor, if the relief valve did not limit this pressure.

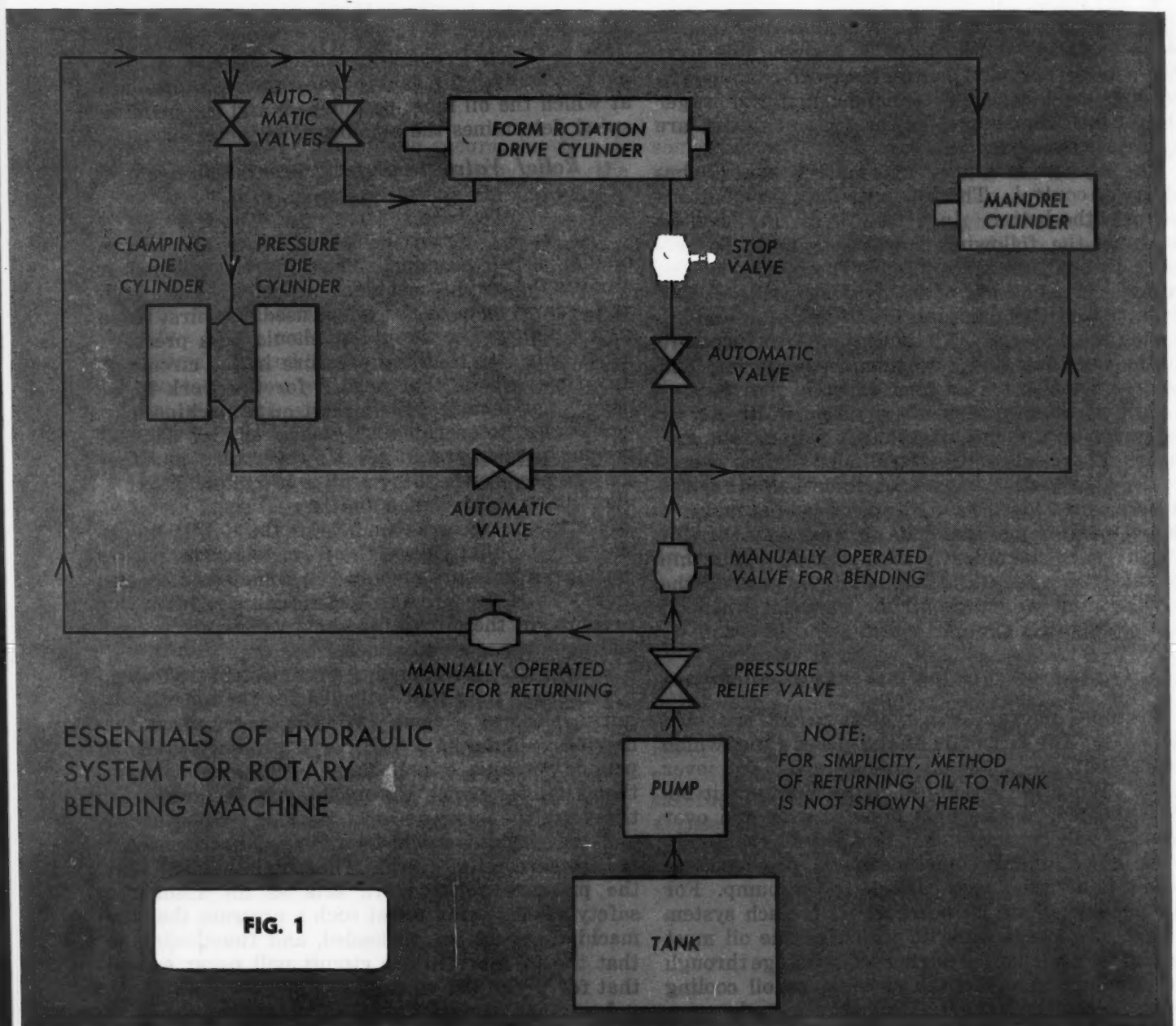
Other Valves Used to Control the Direction of the Oil into the Various Cylinders

Most of the other valves are used to control the direction of the oil into the various cylinders. They may be either manually operated or automatic in

their action; in most circuits, there is a combination of the two types. Thus in the circuit shown in the illustration, the operator pulls one valve handle manually to start the bending cycle, but automatic valves cause the mandrel, the pressure and clamping dies, and the rotating form, to operate in their proper order. This order is maintained by having the automatic valves so interlocked that they guide the oil to each cylinder in turn. Another manually operated valve and system of automatic valves actuate the reversal of the whole cycle, so that all tools move back into their positions in readiness for the next bend.

It should be mentioned that the accompanying diagram shows a fundamental arrangement only, many variations of this basic plan being possible.

Fig. 1. Typical Hydraulic Circuit for a Pipe or Tube Bending Machine



An example of one such variation is the stop-valve shown in dotted lines. When a large number of bends are to be made at the same angle, this valve may be set so that it will stop rotation of the form when the bend has been made to exactly the required angle.

One necessary, but easily forgotten, factor in the design of hydraulic circuits is the provision for emptying the various cylinders. For instance, suppose the bending arm is returned to its initial posi-

tion, which means that the piston is at one end of the cylinder and the rest of the cylinder is filled with oil. Now, for the next bend, the piston must be forced back to the other end of the cylinder by oil entering at the end where the piston now is; but in order for the piston to move back, the oil that is already in the cylinder must be given an opportunity to escape. The piping and valves must be so arranged that this is possible for all cylinders, in both directions.

Indium—A Metal Acquiring Industrial Significance

THE activity of the war years has brought to the front the metal indium, once an extremely rare metal and a laboratory curiosity. According to William S. Murray, president of the Indium Corporation of America, in a talk before the Philadelphia Chapter of the American Chemical Society, indium is, in itself, a soft metal, but the use of only a small amount of it will bring to non-ferrous metals greater tensile strength, increased hardness, and increased resistance to wear, friction, abrasion, and corrosion.

In physical appearance, indium is a silver-white crystalline metal, softer than lead, malleable, and ductile. It is stable in dry air at room temperature, but, upon heating, it will ignite and burn with a blue flame to produce indium trioxide. In some ways, it is similar to zinc, and in others it is like aluminum and iron.

Indium was discovered by two German scientists in 1863; but until the early twenties, when Dr. Murray obtained a very small amount of this rare metal and discovered its value in stabilizing non-ferrous metals, little interest had been shown in this element. Indium is present in some zinc ores and in the ores of some other metals, so that now a constant supply is available.

Among its various applications, indium is used in dental alloys, for producing strength, hardness, and resistance to wear; in silverware, where small percentages result in a material hardening of the silver; for alloying with copper, when it produces a metal of attractive finish that can be highly polished and is not susceptible to oxidation or sulphidation; as a brazing alloy for certain ranges of temperatures; and in silver-lead aviation bearings. In the latter case, it is stated that indium increases the strength of the bearing material, prevents corrosion of the bearing surface, and permits it to retain its oil film more completely by increasing its "wettability." Indium has also been used in coatings for brass where protection of metallic surfaces was required under conditions of extreme climatic corrosion. After one year, the indium alloy coating showed no evidence of corrosion.

Indium is electroplated on a clean non-ferrous metal surface. It is necessary that the indium become diffused into, or amalgamated with, the base metal. To accomplish this, the plated part is placed in an oven or in a hot oil bath, and subjected for about two hours to a heat-treatment at a temperature of 350 degrees F., which is slightly above the melting point of indium—311 degrees F.

The present cost of indium is \$3.66 per troy ounce of metal 99.9 plus per cent pure. New sources of supply and new methods of separating the metal from its ores will tend to reduce the cost.

* * *

Film for Engineering Classes

Unusual manufacturing operations with specially designed machinery have been photographed in a moving picture produced by the Clark Equipment Co., Buchanan, Mich. This film, which is being exhibited in leading technical schools for use in engineering class instruction, pictures such operations as the making of a one-piece forged axle housing from a single plate formed into a tube; silent blind riveting, from one side only; material-handling by means of fork lift-trucks and industrial tractors; and twisting high-speed drills into spiral form from forged blanks.

* * *

Those who clamor for jobs created by the Government should try to understand that Government cannot create purchasing power; it can only redistribute it—that is, take it from one and give it to another. This does not increase the nation's wealth or its actual national income; it is merely a case of taking the money out of the pockets of some citizens and putting it into the pockets of others. As is pointed out in a publication by Stevenson, Jordan & Harrison, Inc., management engineers, a nation's purchasing power can be permanently increased only by increasing production.

Utilizing Residual Forming Stresses

THE countless types of mechanism parts being designed today call for a wide variety of stress requirements. In some components, the design of which is determined simply by the need for a certain mass, stress is of no particular significance. In others, such factors as material cost, space limitations, or low mass requirements make the operating stresses of prime importance.

It is the latter cases that call for careful consideration of both the stresses resulting from external loads and the internal stresses "locked up" in the material by heat-treatment or forming operations. These internal stresses, if not relieved, may, in some instances, appreciably reduce the external load which may be safely applied to the part. In other cases, these internal stresses may be taken advantage of in such a way as to materially aid in satisfying the load requirements of the design. It is the purpose of this article to show the effect of residual stresses induced by forming operations on flat spring design.

The Effect of Residual Stresses, Resulting from Forming Operations, on Flat Steel Spring Performance

The general function of a spring is the storage of energy, and as a consequence, it usually must meet high stress requirements in order to operate efficiently. In setting up the manufacturing procedure, it is important, therefore, to know what internal stresses, such as those resulting from forming operations, will be present, and to determine their effect on the operation of the spring. The formation of residual bending stresses and the marked effect they have on spring performance will now be discussed.

Stress Conditions Accompanying Bending

For simplicity, our consideration will be confined to the stresses operating in a flat piece of tempered spring-steel strip during bending and springing back. If the straight spring material is supported at two points on a press and loaded at the mid point, the maximum fiber stress S operating during elastic bending at any section can be determined by the elementary beam formula:

$$S = M \times \frac{c}{I}$$

where

M = bending moment at section, which varies from zero at supports to a maximum directly under load;

c = distance from neutral axis to surface of strip;

I = moment of inertia of cross-section of strip; and

$\frac{c}{I}$ = reciprocal of section modulus.

Since only the section at which the maximum flexural stress occurs is significant with respect to forming the spring and its operating service, only this section, which is directly under the load, will be considered.

Fig. 1 illustrates schematically the change in stresses that occurs in this section of maximum moment at two points during the first half of the bending cycle. The upper diagram shows the stresses shortly after the bender strikes the part.

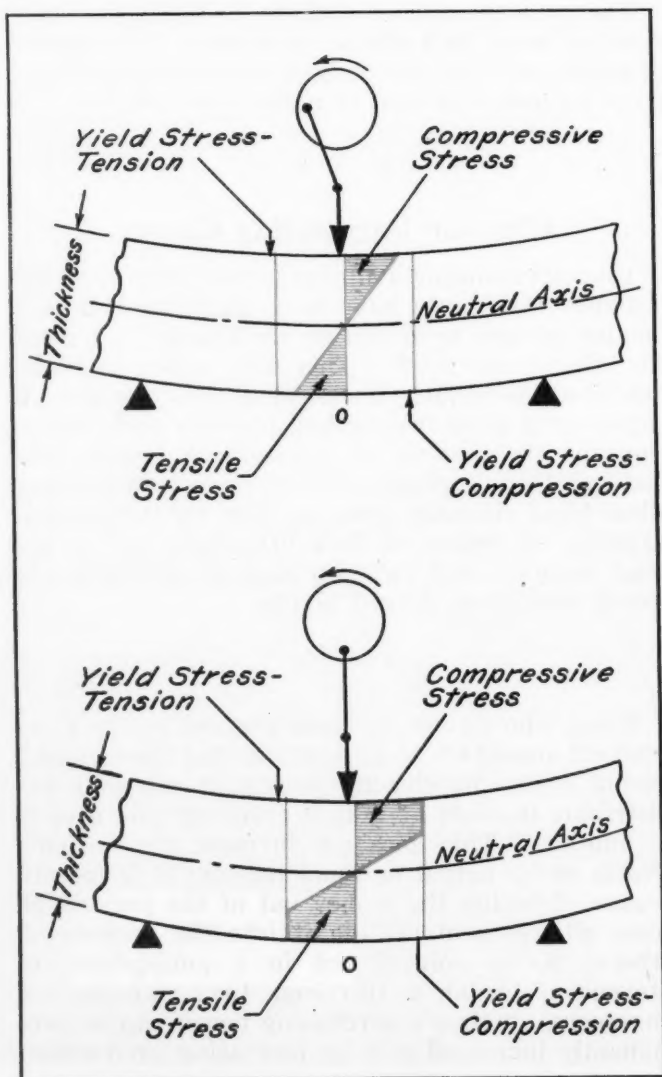


Fig. 1. Flexural Stress at Two Points in the First Half of the Bending Cycle on a Spring-steel Strip. Lower Diagram Shows that Maximum Fiber Stress Remains at Yield Strength as Plastic Deformation Takes Place

in Flat Steel Springs

By W. C. TROY, Materials Engineering
Westinghouse Electric Corporation
East Pittsburgh, Pa.

formance and the Way in which These Stresses Can be Utilized to Improve Spring Strength

The lower diagram shows the stresses when the bottom of the stroke has been reached. These two diagrams are based upon the condition that work hardening is not taken into account. As the press deforms the part, the fiber stress increases with increasing load up to the yield stress. As the load increases still further, enough yielding in the outer fibers occurs so that the stress in these fibers remains at the yield strength. (It is this yielding that gives rise to the pattern of residual stresses existing after the piece springs back when the load is removed.)

After the bottom of the stroke is reached and the load begins to decrease, the stresses in the part again change in accordance with the beam formula; that is, as the load is reduced, the fiber stress drops off correspondingly. This progressive change in the stress pattern as the load is removed is indicated in Fig. 2 by the stress curves for three different points in the last half of the bending cycle. The part progressively springs back and the stresses change until that position of the spring is reached where the summation of moments from the neutral axis to the outer fiber is zero. The stress distribution then existing in the spring, that is, when bending is completed, is shown by the last curve in Fig. 2.

Two Possible Combinations of Applied and Residual Stresses

In Fig. 3 is shown the distribution of actual stresses under maximum load for two different conditions. The upper diagram represents the first condition, in which the residual stresses in the extreme outer fibers are opposed to the stresses imposed by the external load. With this condition existing, it is evident that the resultant stresses in the extreme outer fibers will be less than those imposed by the load. In the second condition (lower diagram), the residual stresses in the extreme outer fibers add to the stresses imposed in these fibers by the load. The resulting stress is, therefore, greater than that caused by the load alone—obviously, an unsatisfactory condition in many in-

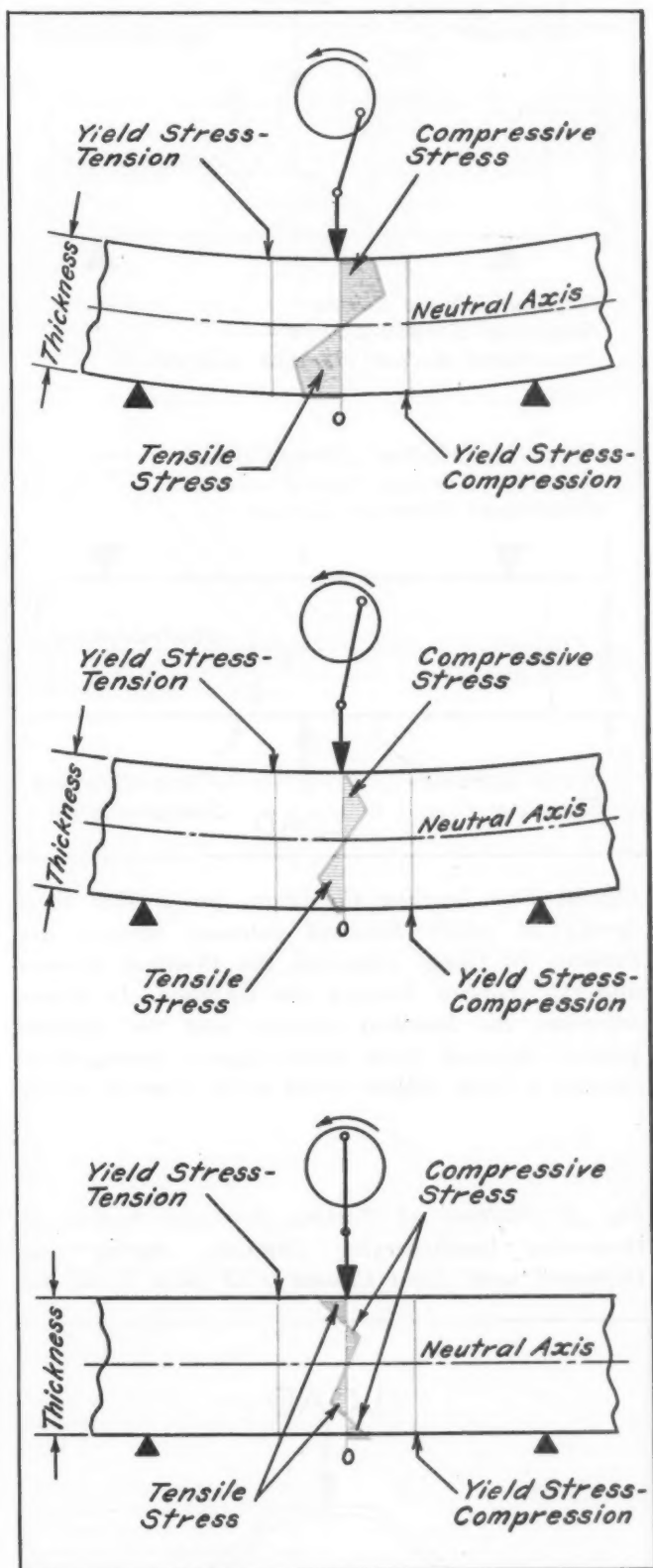


Fig. 2. Flexural Stress at Three Points in Last Half of Bending Cycle. Because of Plastic Deformation or Set which Occurred in Fig. 1, the Permanent Pattern of Residual Stresses Shown in Lowest Diagram Remains after Bending Load is Removed

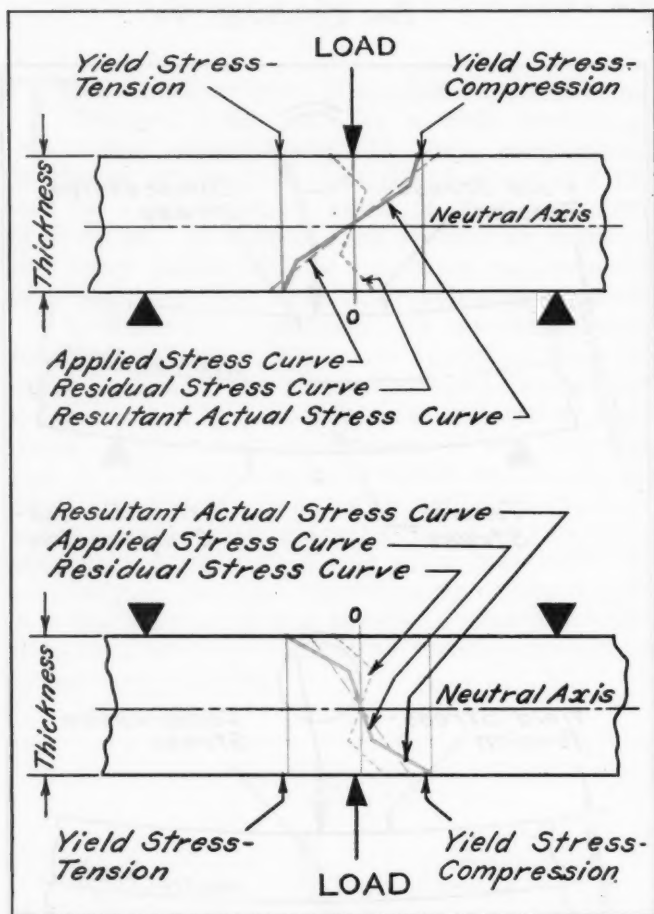
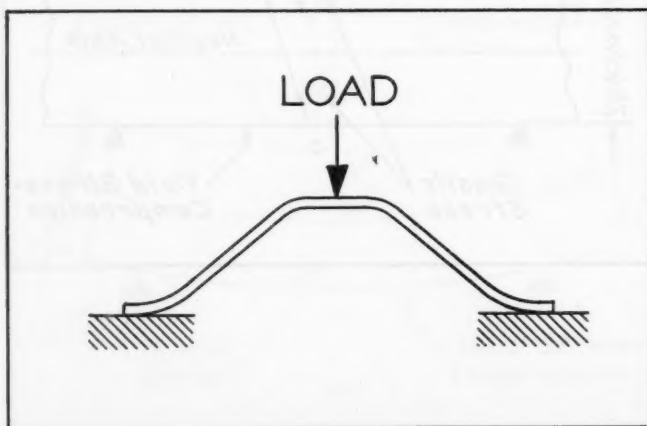


Fig. 3. Two Loading Conditions for a Flat Steel Spring in which Residual Internal Stresses are Present. In Upper Diagram, the Residual Stresses and the Applied Stresses are Opposed. In Lower Diagram, the Residual Stresses and the Applied Stresses Augment Each Other. Upper Arrangement Permits a Much Higher Load to be Carried Safely

Fig. 4. Method of Testing Pressure Spring to Determine Load-carrying Capacity. Spring was Deflected until Load Caused 1/32 Inch Total Set



stances. In other words, incorrect application of a spring in which residual stresses exist may result in the yield strength being exceeded by a service load which would be quite safe if the internal stresses either were absent or acted in opposition to the load stresses.

Thus, it becomes apparent that when highly stressed springs are to be formed from pretempered material, the relationship between residual stresses and service stresses must be carefully established before manufacturing operations are set up. This will indicate whether the residual forming stresses should be removed by subsequent stress-relief annealing or whether they may be utilized to function as a "hidden reserve of strength" and thus increase the allowable load applied to the spring. The very phenomenon that might impede the efforts of an uninformed designer may be controlled to aid the one who understands and investigates this relationship.

Example of a Static Pressure Spring

In order to illustrate the significance of residual stresses with respect to spring performance, the actual case of a pressure spring will be reviewed in detail. This specimen spring was formed from 0.042 inch by 0.5 inch pretempered carbon steel spring strip having a hardness of 42 to 43 Rockwell C. The forming dies were so adjusted that the desired contour was obtained in the piece after it had sprung back from the forming stroke. Fig. 4 shows the shape of the spring and the direction of loading in service.

In making specimen springs of this design for test, the manufacturing procedure was varied to produce three groups of springs, each group having a different internal stress condition, as follows:

Group 1. The springs were formed from pretempered strip to the required curvature. No other operations were performed.

Group 2. The same procedure was followed as for Group 1, except that, after bending, the springs were heated to a temperature of 425 degrees C. and held at that temperature for one hour to partially relieve stresses without reducing the hardness.

Group 3. The springs were formed to the required curvature, and were then fully annealed and again heat-treated to exactly the same hardness range as before.

From these manufacturing procedures, three stress conditions resulted, namely, in Group 1, the full value of residual stresses from forming was present; in Group 2, only part of the residual forming stress was present, the stress relief heat-treatment having removed the remainder; and in Group 3, there was complete freedom from any forming stresses, since full annealing and heat-treatment had completely removed the previous stress pattern.

Since all three groups of springs were carefully processed to the same hardness, they presented an opportunity to evaluate the internal stresses present in Groups 1 and 2. This was possible because the yield strength of the steel itself, neglecting the effect of internal stress, was uniform in each of the three groups as a consequence of their hardness uniformity. Accordingly, the springs were tested as shown in Fig. 4. The load applied was progressively increased for the springs in each group until a load was obtained that caused a 1/32-inch set in the free height of the spring. This load was designated as the "load-carrying strength," and is given in Table 1 for the three groups of springs.

Inasmuch as the springs in Group 3, which were quenched and tempered after forming, were free from forming stresses, the maximum stress in these springs when setting began to take place would actually be equal to the yield strength, and, therefore, could be estimated from the hardness.

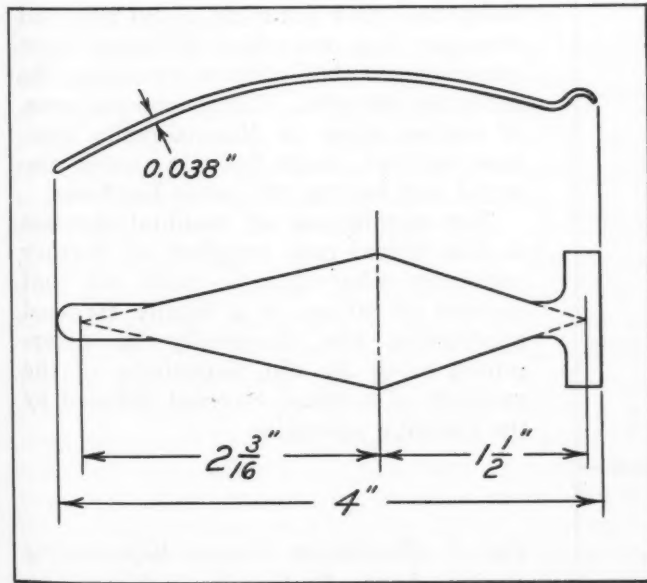


Fig. 5. Sketch of Operating Spring Used to Maintain Pressure on an Electrical Contact

Table 1. Results of Load Tests on Pressure Springs

Group No.	Method of Manufacture	Load-Carrying Strength, Pounds*	Apparent Yield Strength, Pounds per Square Inch†	Effective Residual Stress, Pounds per Square Inch‡
1	Using pretempered spring steel strip, the springs were formed to the required curvature. No other operations were performed.	40 39 Average 40 40.5 43	100,000	80,000
2	Same as for Group 1, except that springs were stress-relieved for 1 hour at 425 degrees C. after being formed.	60 61 Average 63 61.3	152,000	28,000
3	The springs were completely formed, after which they were fully annealed and rehardened to exactly the same hardness as the original spring strip.	76 72 Average 74 72.8 69	180,000	0

*The "load-carrying strength" values were determined by loading the springs as shown in Fig. 4 until a 1/32-inch permanent set occurred.
†The "apparent yield strength" values were obtained by assuming that in Group 3 the actual yield strength of 180,000 pounds per square inch was reached, and then computing the values for Groups 1 and 2 as being directly proportional to the load-carrying strengths.
‡The "effective residual stress" values were obtained by subtracting the apparent yield strength from the actual yield strength value of 180,000 pounds per square inch.

At a hardness of 43 Rockwell C, the yield strength can be assumed to be 180,000 pounds per square inch. Since these springs were found to take a set at an average load of 72.8 pounds, and the internal

Table 2. Effect of Forming and Heat-Treating Methods on the Load-Carrying Strength of Springs

Treatment to which Spring was Subjected	Load-Carrying Strength, Pounds*	Apparent Yield Strength, Pounds per Square Inch†
Flat blank heat-treated before forming large curvature. No stress relief.	14	52,000
Same as above, except stress-relieved for two hours at 200 degrees C.	26	97,000
Same as above, except stress-relieved for two hours at 410 degrees C.	46	171,000
Heat-treated after complete forming; no further operations.	56	208,000
Large curvature formed to excessive free height before heat-treatment, and then rebent to give specified free height after heat-treatment.	65	242,000

*This value was determined by supporting the springs at the ends and loading at the point of maximum section modulus until that value of load was obtained which caused the spring to set.
†Using the ordinary beam formula, this value was calculated from the loads listed under "Load-Carrying Strength."

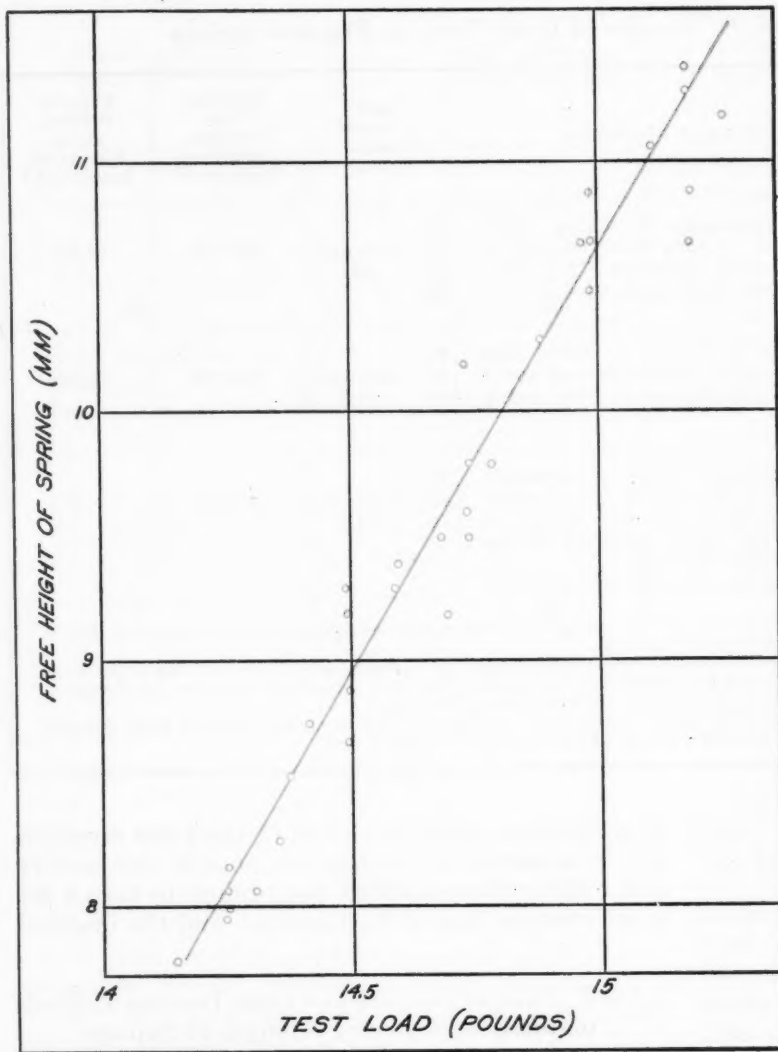


Fig. 6. Plot of Free Height and Deflection Test Values for the Spring Shown in Fig. 5. Arrangement of Points in "Scatter Band" Embracing Plotted Line Confirms Dependence of the Deflection Test Value on the Free Height

stresses are assumed to be negligible, it follows that 72.8 pounds load had induced a maximum fiber stress of 180,000 pounds per square inch.

Accordingly, since the applied maximum fiber stress varies directly with the load, the stress produced by the load which caused setting in the Group 1 and Group 2 springs is readily calculated. These values are listed in Table 1 under the heading "Apparent Yield Strength."

By subtracting these apparent yield strength values from 180,000 pounds per square inch, which is the true inherent yield strength of the steel, an effective value for the amount of residual forming stress was obtained. These resultant values, which are designated "Effective Residual Stress," are listed in Table 1.

From the tests on these pressure springs, it is apparent that 45 per cent of the load-carrying capacity of this spring would be lost if the manufacturing process resulted in the residual forming stresses being additive with respect to the applied service stress. Also, it follows that a spring of this type, which has been quenched and tempered after forming, is 80 per cent stronger than one which is formed from pretempered steel without removing the forming stresses. These comparisons, of course, apply to dimensionally identical springs, made from the same material and having the same hardness.

The significance of residual stresses in this actual case requires no further summary other than to point out that success or failure in a highly stressed application can frequently be determined solely by the disposition of the problem of residual stresses induced by the forming operation.

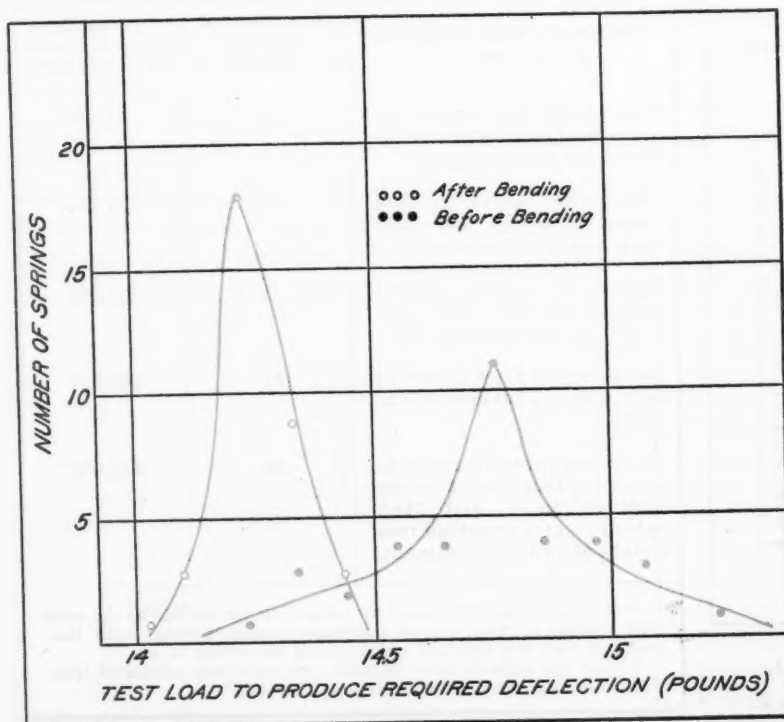


Fig. 7. Distribution Curves Representing Spring Load Uniformity Achieved by Bending Operation Used on Spring Shown in Fig. 5 to Establish Favorable Residual Stresses and Uniform Free Height

Example of an Operating Pressure Spring

A second case will be presented to illustrate the manner in which residual stresses can be deliberately introduced into a spring in order to improve its performance by causing the residual stresses to oppose the applied service stresses. The function of this particular spring was to furnish pressure to an electrical contact. Fig. 5 illustrates the shape of the spring, which was made from 0.038-inch SAE 6150 spring steel, heat-treated after forming.

In the manufacture of this spring, two problems presented themselves: (1) The obtaining of a uniform load when the spring was deflected to a given final position in testing; and (2) the obtaining of freedom from set when the spring was subjected during assembly to a load somewhat in excess of the test load.

It is evident, of course, that the free height or camber of the spring determined the load necessary to deflect it to the final position. This fact was confirmed by the study of a number of springs which were identical, except for free height. Fig. 6 is a plot of the free height versus the test load necessary to deflect the spring to the final position. Obviously, control of the test load consisted essentially in control of the free height of the spring. The method of controlling the load will be demonstrated later, since the usual manufacturing method of heat-treating such a spring to the final shape after forming results in excessive non-uniformity in load due to heat-treating distortion.

As previously mentioned, it was a requirement that, during assembly, the spring must support a temporary load greater than its normal test load. Since the temporary load actually imposed on the spring a stress in excess of its yield strength, set and loss of normal load were to be avoided only by precise control of residual stresses, so that they would oppose the applied stresses and reduce the actual maximum fiber stress to some value below the yield strength.

In order to evaluate the influence of internal stresses in this spring, there was prepared a group of springs which were identical except that the residual stresses were intentionally varied from the most unfavorable to the most favorable condition. The least favorable stress condition, that is, the condition in which the full value of residual stress is added to the stress induced by the applied load, was established by heat-treating the flat blank before forming the large curvature on the spring. The most favorable stress condition was obtained by forming the large curvature to a radius considerably smaller than that specified before heat-treatment, and then reducing the free height to the specified value after heat-treatment. Intermediate values of residual forming stresses were obtained by partially stress relieving the springs having unfavorable stresses. The stress-free condition was produced by simply heat-treating the spring after complete forming. The hardness of all the springs was controlled to come within 48 and 49 Rockwell C.

After establishing the various residual stresses,

the springs were supported at the ends and loaded at the point of maximum width. A determination was made of the load necessary to cause setting. This load was termed the "load-carrying strength," and from it was calculated the apparent yield strength of the spring. Table 2, which includes the values obtained in this test, demonstrates again the wide variations in effective strength that can be obtained in springs which are apparently identical, but which carry different residual stress conditions. It is evident that careful control of these stresses permitted the use of this spring under conditions that otherwise would have caused the yield strength to be exceeded.

Method of Producing Uniformity of Free Height of Spring

Mention was made previously that normal forming and heat-treatment resulted in non-uniformity of free height, which was inconsistent with the application. By referring to Fig. 7, it will be seen that setting of the spring, that is, deflecting it beyond its yield strength, provides a method of producing uniformity of free height by a press operation. When the spring was deflected past the point at which yielding occurred, the stress in the outer fibers naturally could not exceed the yield strength in those fibers and, therefore, remained substantially uniform, neglecting the effect of work hardening. Since the stresses in the spring at the bottom of this setting stroke establish the couple responsible for spring-back, and since these stresses approach a uniform value when the bottom of the stroke is reached, the operation is inherently a method for improving the uniformity of free height of otherwise non-uniform springs.

The uniformity achieved by this operation is illustrated in Fig. 7, which shows a distribution curve for the same group of springs before and after the setting operation. It is significant that the setting operation is the same as that by which the springs were deformed to produce the favorable residual stresses described in Table 2. Thus, by a single operation, uniformity in free height and favorable residual stresses were obtained.

It is evident, from the data describing this actual case, that the ability of the spring to withstand application of a load beyond its normal yield strength depended simply upon a diagnosis of the influence of residual stresses upon its performance. This diagnosis, followed by a realignment of manufacturing operations to establish the most favorable residual stresses, led directly to a 16 per cent increase in the strength of the spring. This increase, which involved no additional operations or material, provided that increment of strength necessary to safely meet the assembly requirements of the part.

* * *

He that invents a machine augments the power and well-being of mankind.—Henry Ward Beecher

Surface Grinding with Cylinder and

Types of Machines Used and Examples
of Work Ground with Cylinder and
Segmental Wheels—Second in a Series
of Articles on Modern Surface Grinding

By J. C. ARNDT and
W. S. HALLOWELL
Simonds Abrasive Co.
Philadelphia, Pa.

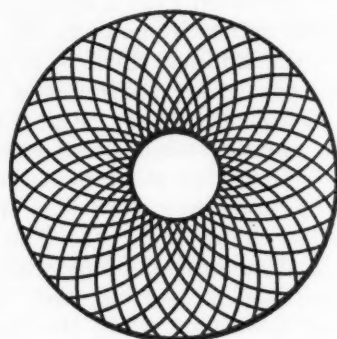


Fig. 1. Grinding Lines Generated
in Rotary-table Grinding

MUCH flat surface grinding is done either with a cylinder wheel, known as Type No. 2, or with one of several designs of segmental wheels. Both types are essentially hollow cylinders which grind on the flat edge at the end. It is this characteristic that chiefly determines both the advantages and disadvantages of the method. Wheels of these types are capable of removing large amounts of material rapidly, due mainly to the considerable area of abrasive in contact with the work, as compared with the line contact of a wheel grinding on its periphery. Material removal of from 1/16 to 3/16 inch is common when grinding to good accuracy. In fact, as much as 1/4 inch of stock is regularly ground from large areas of steel and semi-steel die-shoes, grinding from

the rough. In cases where the area of contact between the wheel and the work is small, still heavier cuts can be taken, as in removing the bell-mouths from the ends of the bores of Nitralloy cylinder barrels. On such work 7/16 inch of material is removed to limits of ± 0.0025 inch. The area of surface presented to the wheel is in the form of a ring, 7 1/2 inches outside diameter by 6 3/4 inches inside diameter. Six barrels are ground at one set-up; the time required is 2 1/2 minutes per end. Another advantage of this grinding method is that the flat grinding surface of the cylinder wheel bridges interrupted surfaces, and so does not round off the edges, as may happen when grinding with the periphery of a straight wheel.

The method has its limitations, however. The wheel must have a clear sweep across the piece if the grinding is to be economical. Therefore, there must be no obstacles, such as projections, to interfere with the free movement of the wheel. Because of the large area of contact between wheel and work which is usual, considerable heat is generated, and even when using segmental wheels, it is not so easy to get an adequate supply of coolant at the point of contact as with straight wheels.

While it is generally true that heavy material removal and close accuracy do not usually go together, it is possible, by choosing the right type of machine, to get accuracy by this method as close as 0.0002 inch. On production jobs, however, it is better to count on limits of about 0.0005 inch.

Because most of the machines using cylinder or segmental wheels have vertical spindles, it is common



Fig. 2. Example Showing the Grinding
of Large Work on a Blanchard Machine

Segmental Wheels

to refer to this type of grinding as "vertical-spindle grinding." This is a misnomer, however, since some machines employing wheels of these types are known as "face grinders" and have the spindle horizontal.

Vertical-spindle machines are of two types—those that hold the work on a rotating table, and those having a reciprocating table. For grinding, the rotary table is traversed longitudinally until it is under the grinding wheel, but the work movement is entirely rotary.

The surface generated is similar to that shown in Fig. 1, except that the lines are, of course, much closer together than can be readily shown in a drawing. The crossing lines are due to the fact that when the spindle is correctly set, the wheel cuts both while moving toward and while moving away from the center of the chuck. It is claimed that these crossing lines are a check on the flatness of the piece, and that, if necessary, a degree of flatness that can be measured only with an optical flat is possible. Other advantages are good wheel action and little likelihood of overheating. When grinding a continuous circular group of workpieces, there are no end pieces subjected to cutting action in only one direction. This uniform treatment of all pieces makes for uniform accuracy.

Some examples of surface grinding on rotary-table machines are illustrated in Figs. 2 to 6, inclusive. Fig. 2 shows a single large piece loaded on the rotary table of



Fig. 3. (Top) Grinding the Ends of Ten Cylinder Sleeves at One Setting on a Hanchett Machine

Fig. 4. (Center) Variety of Plain and Compound Dies Finished by Surface Grinding

Fig. 5. (Bottom) Two-spindle Blanchard Machine which is Fully Automatic except for Placing the Work on the Dial Loading Device

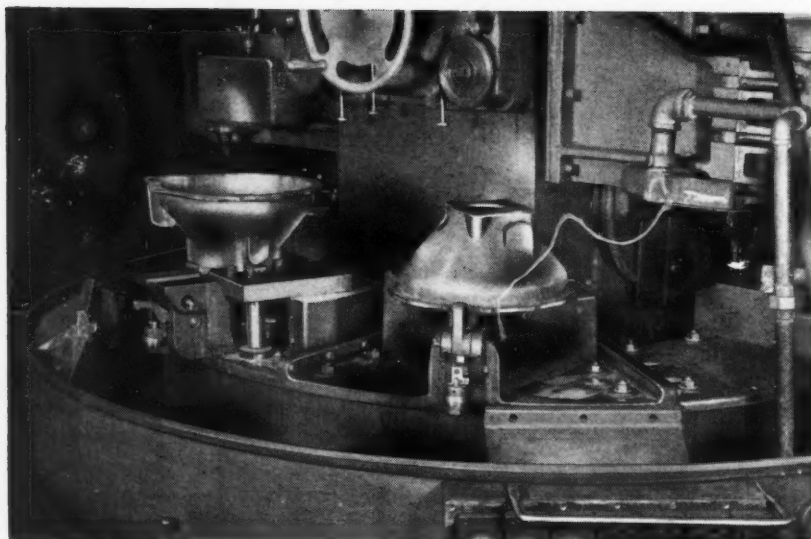


Fig. 6. Grinding Cast-iron Transmission Cases on a Three-spindle Hanchett Machine

a Blanchard machine. This is an aluminum casting from which $5/32$ inch is removed from both sides, which must be parallel to within 0.0015 inch. The piece is lightly strapped to a steel plate which remains on the magnetic chuck. Two pieces are ground on two sides in one hour.

Fig. 3 shows a Hanchett machine grinding the ends of ten cylinder sleeves at each setting. The mechanically operated fixture is mounted on a rotating magnetic chuck. The wheel is segmental. The ability to grind either a single piece or chuckloads of smaller pieces makes for great versatility, suiting the machine either to tool-room work or to high-production jobs.

In Fig. 4 are shown various plain and compound dies ground on a Blanchard machine. The rotary table motion, with the cylinder or segmental wheel covering the entire surface of the die at each revolution of the work, enables the operator to remove

work as it leaves the machine.

In Fig. 5 is shown a two-spindle Blanchard machine which is fully automatic except for placing the work on the dial loading device shown to the right. The dial is a tempered steel disk driven from the chuck drive at a slightly higher rim speed than the chuck. By loading the circumference of the dial with a full load of pieces, a steady stream of parts is supplied to the chuck, with only occasional attention from the operator. In the job shown, 1200 pieces are ground on both sides per hour to limits of ± 0.0005 inch. The material is hardened alloy steel.

Multiple-spindle machines can be used for pieces from which more stock must be removed than could be ground off in a single pass under one wheel; or they can be used for taking rough and finish cuts, or in the case of three-, four-, or five-spindle machines, rough, semi-finish, and finish cuts, one or more wheels being used for each stage.

Fig. 6 shows the grinding of both sides of cast-iron transmission cases on a three-spindle Hanchett machine, using silicon-carbide segmental wheels. The first wheel, of 20 grit, rough-grinds the casting, the second, 30-grit, wheel semi-finishes, and the third, 60-grit, wheel finishes the surface. Eight fixtures are used, arranged in pairs, one fixture in each pair being for grinding one side.

Grinding on Reciprocating-Table Machines

Cylinder and segmental wheels are also used on machines equipped with reciprocating tables, as mentioned. The wheel-spindle may be

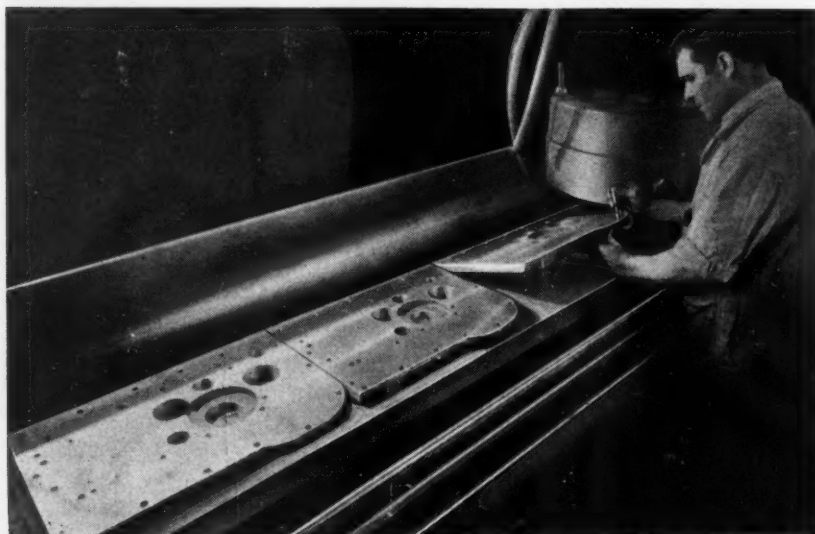


Fig. 7. Machine Tool Covers being Ground on a Pratt & Whitney Machine

either vertical or horizontal, as in the case of rotary-table machines. The surface pattern produced by the combination of cylinder wheel and reciprocating table consists of overlapping curves, sometimes called "Dutch finish," which is preferred by many designers as the finish for sliding bearing surfaces.

While this method is excellent for grinding interrupted surfaces, excessive heat is likely to be generated when grinding large unbroken areas. This is especially true when grinding very thin parts at low table speeds. If a soft, free-cutting wheel is used, the wheel wear will be excessive. If the machine is equipped to give table speeds in the high range—say around 100 feet per minute—harder wheels can be used without excessive heat. On such machines, very thin parts can be safely and effectively ground. A case in point is the grinding of internal thread-gage blanks 1 1/2 inches in diameter by 1/4 inch thick, which are ground ninety to a chuckload, removing 1/32 inch of stock to a tolerance of 0.0005 inch on the thickness. The grinding time per load is 4.8 minutes. A machine of this type is shown in Fig. 7. The parts are typical machine tool covers being ground on a Pratt & Whitney machine.

Fig. 9 shows a Hanchett reciprocating-table ma-

chine grinding a rough casting, 12 by 18 by 3 1/2 inches, just as it comes from the foundry; from 1/16 to 1/8 inch of material is removed from the bottom and the four pads on the top. The piece is finished complete, except for subsequent drilling and tapping, in thirty minutes. The grinding wheel is segmental, 22 inches in diameter by 2 inches face, and is driven by a 40-H.P. motor.

Fig. 8 shows typical operations performed on a Mattison vertical-spindle, reciprocating-table grinder in grinding angular ways or surfaces. This machine may be provided with straight, straight-cup, flaring-cup, or dish wheels. One of these four types will effectively grind any kind of bearing surface found on the ways of tables, slides, saddles, heads, turrets, or similar parts. This method gives close accuracy and fine finish at low cost. It often eliminates the need for hand-scraping, and thus makes possible the use of hardened steel ways which could be finished in no other way.

Typical face grinder jobs on a horizontal-spindle, segmental-wheel Hanchett machine are shown in Fig. 10. Formerly these castings were milled or planed. Grinding by this method has tripled production. The wheel used is segmental, HA-36 shape, specifications C241-H9-V3. The average stock removal from each surface is 1/16 inch.

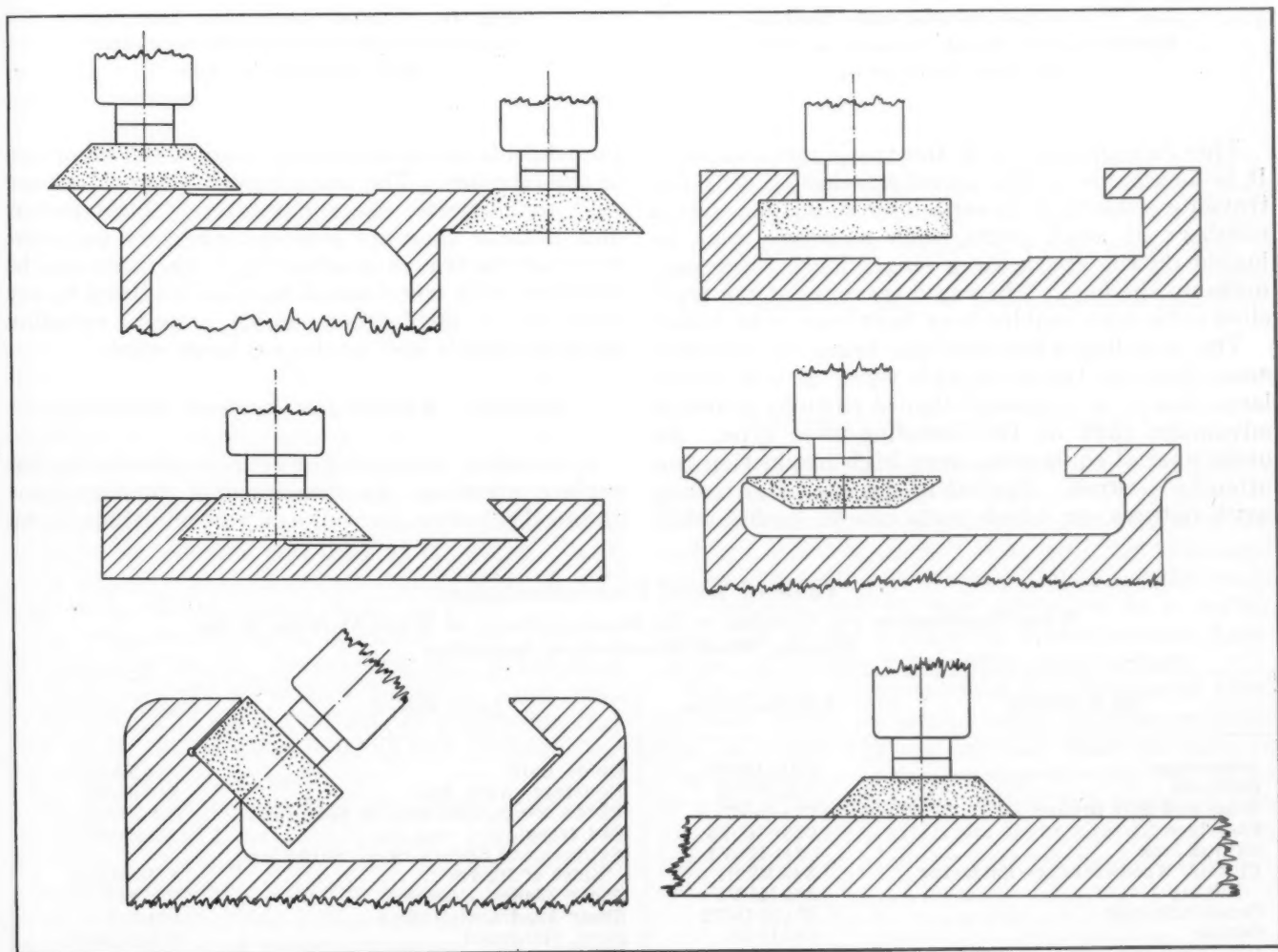


Fig. 8. Typical Operations Performed on a Mattison Vertical-spindle Reciprocating-table Grinding Machine

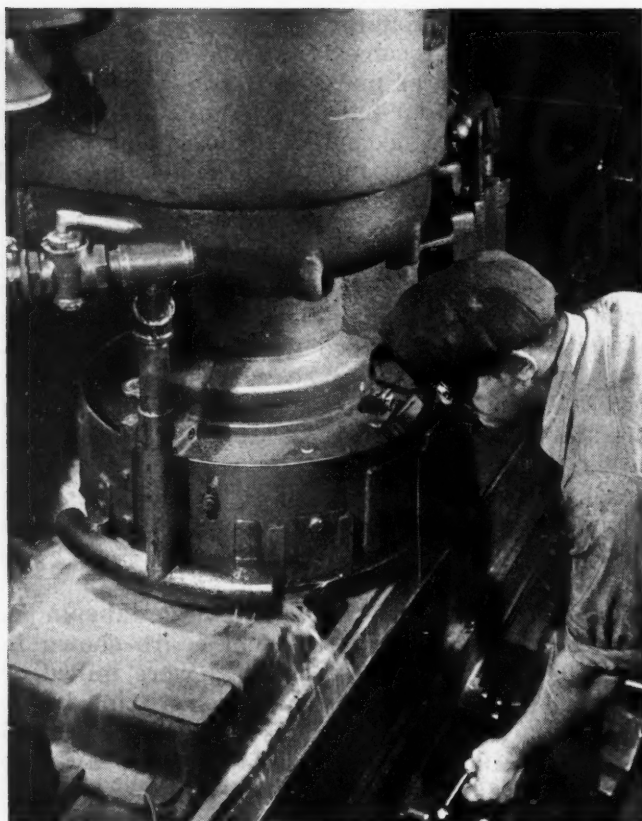


Fig. 9. A Reciprocating-table Machine Grinding Large Rough Castings as They Come from the Foundry



Fig. 10. Typical Face-grinder Jobs Performed on a Horizontal-spindle Segmental-wheel Hanchett Machine

This face grinder is of the traveling-table type. It is also made in the traveling-wheel type. The traveling-table type is especially versatile. Large numbers of small parts, such as rings, may be loaded on the chuck, or a single large piece may make up the load. The rapid traverse of the traveling-table type enables very light cuts to be taken.

The traveling-wheel machine takes up less floor space than the traveling-table type. It will handle large, heavy, or awkward-shaped castings to better advantage than on the traveling-table type. By using special equipment, very high production can often be secured. Typical is the use of swiveling work fixtures, on which parts can be loaded while

the wheel is grinding another load at the other end of the machine. The traveling-wheel machines are easy to lubricate, use comparatively little power, and, because they are compact, are very accurate. Some of the traveling-wheel type machines can be equipped with wheel-heads that can be tilted to any angle up to 30 degrees, which permits grinding accurate bevels and angles on large work.

Selecting Wheels for Surface Grinding

In selecting segmental or cylinder wheels for flat surface grinding, the fundamental considerations of wheel selection, as well as a few additional ones,

Table of Wheel Recommendations

Wheel Specifications are according to the Standard System of Wheel Markings of the Grinding Wheel Manufacturers Association

Job or Material	Wheel Specification	Job or Material	Wheel Specification
Aluminum	C241 H9-V3	Guide Bars	A16-N5-V2
Bathtubs	A24-S5-V2	Housings, Auto Axle	A16-05-V2
Brass and Soft Bronze.....	C24-I9-V3	Piston Rings, Cast-iron or Semi-steel	C30-J9-V3
Cast Iron	C241-H9-V3	Sad Irons	WA16-I8-V1
Chilled Iron	C241-H9-V3	Scissors and Shears, Steel, Surfacing	
Chisels, Woodworking—Surfacing ..	A46-M7-B1	Sides of Blades	A150-M7-B1
Edging	A60 M5-V1	Shear Blades, Segments	NA241-H7-V2
Connecting-rods	WA24-I8-V2	Shear Blades, Cylinders	A24-K-S
Copper	C16-I9-V3	Steel, Hardened	WA30-H8-V1
Dies, Drawing	WA24-H8-V1	Steel, Soft	NA241-H7-V2
Gears, Hardened Steel	WA30 H8-V1	Steel, High-speed	WA36-G8-V1

apply. Thus, aluminum-oxide abrasive is used for materials of high tensile strength, and silicon-carbide for materials of low tensile strength or of great hardness.

In selecting the grade of wheel, it is essential to remember that, in general, small areas of contact between wheel and work, high ratios of work speed to wheel speed, and soft materials permit, or require, harder wheels. As a rule, segmental wheels should be used for the rapid removal of large amounts of stock, because the openings between the segments permit a greater flow of coolant at the point of grinding contact, and so reduce the likelihood of burning the work. Cylinder or cup wheels are usually employed for exacting requirements as to accuracy and surface finish.

For grinding on a machine with a reciprocating table, it is usually best to use wheels one grade softer than would be used for grinding the same work on a rotary-table machine.* For the same work, on any type of machine, wheels having segments 2 inches or more thick should usually be about one grade softer than those with thinner segments.

A wheel that is ideally suited to a job will be "self-sharpening," and should not need to be dressed frequently. However, it is well to be able to recognize the symptoms that indicate when dressing is needed. The appearance of the work surface is an excellent indication whether or not dressing is needed. One sign of the need for dressing is a surface that becomes highly polished and is divided into irregular patches. The wheel that generates such a surface is probably too hard or too fine in grit, and should be carefully watched. If deep scratches appear in the polished surface, the wheel should be dressed.

In using coarse-grit wheels on broad surfaces, a wheel that is too hard may stall the motor repeatedly. If reducing the feed does not prevent stalling or creates a highly polished surface, a freer cutting or softer wheel should be substituted. The ratio of work speed to wheel speed is of great importance in surface grinding. Increasing the ratio makes the wheel act softer and vice versa.

In grinding on a rotary-table machine, it must be remembered that the work speed at the center of the table is much less than at the edge. Thus, for a small piece chucked near the center, a very high table-rotation speed should be used.

On reciprocating-table machines using cylinder or segmental wheels, the traverse may range from 15 to 50 feet per minute for ordinary work, and, as has been said, up to 100 feet per minute for very thin work. From 0.002 to 0.005 inch of down feed per traverse is customary.

On rotary-table grinders the down feed may range from 0.001 to 0.002 inch per revolution of the table. The best table speed depends upon the type of the machine and the nature of the work. Greater stock removal will result from light cuts and fast speeds than from the reverse. Wheel wear will also be less. However, the cut should be deep enough to allow the wheel to cut freely. Feeds as

fine as 0.0002 to 0.0004 inch should be avoided, as such light cuts may cause the wheel to glaze.

The practical way to determine the best table speed and depth of cut for any job is to experiment, starting with a feed of 0.001 inch. If the wheel should glaze, open it up by dressing it with a silicon-carbide stick. Reduce the table speed and increase the down feed for the next try. If the wheel should then act too soft, increase the table speed and decrease the down feed. A little experimenting along these lines will give the right cutting action for the specific job.

While it is seldom possible to select the exact wheel for a specific job from any table, it is usually feasible to make a tentative selection which will be satisfactory. The wheels recommended in the accompanying table should come close to being well suited to the jobs. Usually a little manipulation of speeds and feeds will alter the action of the wheel enough to make it perform properly.

* * *

Our Foreign Trade Can be Stifled by Unwise Policies

Unduly great wage increases, desirable as they may seem to the individual immediately benefited, do not make for full employment or national well-being. Unduly high wages that create prices too high in the world's markets will curtail our exports. Full employment, again, requires a large increase in the volume of our pre-war exports. As pointed out in a publication by Stevenson, Jordan & Harrison, Inc., management engineers, we are now facing a condition where we will, for a long time to come, be competing with countries whose wage level is very far below ours. Only through superior production efficiency can we overcome this handicap.

* * *

Automotive Profits Deeply Cut

Automobile manufacturing companies made only one-third to two-fifths as much profit on sales in the war years as in peacetime. Net profits of the industry, after taxes had been deducted, averaged less than 3 cents out of every dollar for the years this country was at war, according to a survey completed by the Automobile Manufacturers Association, excluding automotive parts makers.

Net profits during the first nine months of 1945, the most recent period for which figures are available, averaged 2.94 per cent per dollar of sales, or about the same as the average for the war years of 2.98. This compares with a net profit of 8.25 per cent on sales, after the deduction of taxes, in 1939, and a net profit of 7.07 per cent in 1940.

* * *

Do not be guided by opinions when facts are available.

Present-Day Motor Drives and Other

A Review of Electric Motor Drive Equipment for Special Machine Tool Requirements — Abstract of a Paper Read Before the Recent Annual Meeting, in Cleveland, of the American Society of Tool Engineers

FREQUENTLY we hear comparisons made between mechanical, hydraulic, and electric drives for machine tools. It may be well to emphasize at the very start that even when mechanical and hydraulic drives are used, they are not in themselves a source of power. In every case, a primary source of power is required, and usually this is an electric motor.

Generally speaking, the reason for using mechanical and hydraulic drives is to obtain a wide speed range. Another reason is to obtain an automatic cycle of operations, when it is desired to operate at several different speeds, with changes from one speed to another at a fairly rapid rate. The performance of these functions requires electrical equipment more elaborate and expensive than the ordinary squirrel-cage induction motor commonly used for simple individual motor drives, and it is often difficult to decide which type of drive is the best for a particular set of conditions.

The fact that all three of these drives are used today indicates that there is a place for all three. The actual decision must be influenced not only by the economy of the drive chosen, but by local shop conditions, such as shop manufacturing facilities and the experience of the designing engineers. The decision is not one of whether or not to use electric motors to drive the machine, but whether additional electrical equipment should be employed to eliminate mechanical and hydraulic equipment.

Before deciding that it is necessary to use such mechanical or hydraulic mechanisms to perform certain functions on a machine tool, it may be found that a squirrel-cage induction motor can perform the operation desired. One condition most frequently met is the matter of rapid starting and stopping or rapid reversing. For a long time, it was assumed that it was necessary to allow the squirrel-cage induction motor to run continuously and make use of mechanical clutches and brakes or hydraulic devices for this purpose. Yet, today there are many applications, especially on drilling and tapping machines and small tool-room and turret lathes, where squirrel-cage induction motors are starting and stopping twenty to thirty times a minute and doing the work in a satisfactory manner. It is obvious that this represents a much harder job for the motor and control equipment, but the elimination of clutches and other mechanical devices results in a much simpler mechanical design; and the reduction in mechanical maintenance easily offsets the slight increase in electrical maintenance.

Motor Equipment Now Available for Machine Tool Operation

Today, the electrical industry offers a complete line of multi-speed alternating-current motors giving two, three, or four speeds, and having a total speed range of 4 to 1. There are many instances where these motors will eliminate the need of a set of change-gears, and their use is especially desirable where an automatic cycle is involved, which would mean shifting gears for different parts of the cycle. These motors are quite often used on small turret lathes and automatic screw machines, which, in addition to requiring frequent change in speed, have to reverse sometimes at the rate of twenty times per minute.

While at present there is a tendency to avoid the use of direct-current adjustable-speed motors on machine tools, because many plants do not have a direct-current power distribution system, these still are very useful, especially on the larger types of machines, such as boring mills, engine lathes, and planers. These motors have a 4 to 1 range in speed, or more in some cases, by means of motor field control; and the speeds can be accurately adjusted over the entire range by means of a field rheostat. Motors of this type are specially suitable on spindle drives, because they have a constant horsepower characteristic, which makes it possible to take heavy cuts at low speed and still have high speeds available when it is desirable to take a light or finishing cut. Direct-current motors are also used on the more elaborate adjustable-voltage systems where very wide speed ranges are necessary.

These direct-current motors are used on many severe-duty cycle applications, such as reversing planer drives, where they give an adjustable low speed in the cutting direction and a high return speed. This type of drive, which was developed many years ago, was one of the outstanding early electrical drives, and the elimination of the belt-shifting mechanism and the screeching of belts on each reversal of the planer was an important improvement.

From the foregoing it will be seen that the conventional electric motor is limited to a speed range of approximately 4 to 1. However, the feed drives on milling machines, boring machines, and many types of combination machines require speed ranges of 60 to 1, and in some applications the theoretical speed range required may be 1800 to 1. It is true that the actual number of machines that have this extremely wide speed-range requirement

Electrical Equipment for Machine Tools

By G. A. CALDWELL, Manager, Industrial Control Engineering
Switchgear and Control Division
Westinghouse Electric Corporation
East Pittsburgh, Pa.

is a small percentage of the total built, but so far as dollar value is concerned, it is a much larger percentage, because these machines are among the largest machine tools built. There are also quite a number of smaller tools that have speed-range requirements that are not high—usually 10 to 1; yet this is more than can be obtained with standard electric motors, and some electrical solution is desirable.

Direct-Current Adjustable-Speed Drives

The drives that have been developed for this type of application are known as direct-current adjustable-speed drives; they consist of a direct-current motor and an individual source of direct-current power, which is arranged to supply an adjustable voltage to the armature of the motor. By providing a motor that can have its speed adjusted by field control and also by means of the voltage applied to the armature, the motor can be made to operate over a wide speed range. When the range required is not more than 10 or 20 to 1, the inherent characteristics of the motor and generator are such that a reasonably good speed regulation is obtained without adding any regulating equipment. These drives provide constant horsepower over the speed range supplied by field control of the motor, and a constant torque over the range supplied by armature voltage control.

The Use of Electronic-Tube Rectifiers

It should be pointed out, however, that this type of electric drive does require a separate power source, and therefore presents a problem of finding a suitable mounting space. The power supply takes the form of a motor-generator set or some other form of rectifier for converting alternating-current into direct-current. One of the newest types of rectifiers is the electronic-tube rectifier; it has received a great deal of attention during the last few years, and promises to become very popular with machine tool builders and users. This unit has the advantage of making it easy to combine the control equipment and the rectifier into a single unit, and is usually easier to mount on the machine than a motor-generator. Also, since it is a static device, it is not a source of vibration, which is an undesirable feature on precision machines, such as grinding machines.

While the mounting of this equipment is a problem, usually the space required is approximately the

same as that for a hydraulic drive, since it is necessary to have an alternating-current motor and a hydraulic pump in a hydraulic system. In making a comparison with mechanical devices, it eliminates the necessity of mounting gears, clutches, etc., between the motor and the driven shaft, and this is usually a place where it is desirable to save space.

For speed ranges in excess of 20 to 1, it is usually necessary to add some form of regulating system to automatically adjust the voltage characteristics of the generator to maintain a preset motor speed, independent of load variations, and thus obtain good speed regulation from maximum to minimum. Drives of this type have been in successful operation for several years where the total speed range is from 100 to 1 to 120 to 1. These drives are either of the electronic type or the MG set type with a Rototrol rotating regulator added.

The Rototrol Type of Drive Applied to Planers

The adjustable-voltage planer drive, which was introduced by Westinghouse approximately ten years ago, and which has now been universally accepted, is an outstanding example of the Rototrol type drive. This drive has a total speed range of 30 to 1, so that if the planer is geared for return speeds as high as 240 feet per minute, it still has a minimum cutting speed of 8 feet per minute, and the cutting speed can be adjusted to any speed from 8 feet per minute up.

While this type of drive may, in some cases, increase the cost of the planer as much as 10 per cent, the flexibility of the planer, the speed of reversal, and other features make it possible to increase production from 20 to 30 per cent in many cases. This easily justifies the increase in cost. It is estimated that over 90 per cent of electrically driven planers being built today are using this type of control. The other 10 per cent consist of various types of planers for which, for one reason or another, the user does not feel justified in purchasing the more expensive equipment; in these cases, the rheostatic reversing drive is used, which has been speeded up and improved along with the development of the adjustable-voltage planer drive. Even here, where the electric drive has been very popular, it still has competition from the hydraulic drive, and one prominent planer builder makes this type of equipment exclusively. Usually the hydraulic planers are of the smaller type, and are used for short-stroke rapid reversing work where,

due to the elimination of some of the inertia that is in the electrical drive, a slightly faster cycle of operation can be obtained. It takes only slight modifications in the circuit of the adjustable-voltage planer drive to extend the speed range to 120 to 1, and thereby provide a suitable drive for the feed mechanisms on milling machines, boring mills, and lathes.

During the last two years, the use of electronic equipment has increased and is now adopted on several machine tools. While many advantages can be listed for electronic equipment, the major points are as follows: (1) An infinite number of speeds over a wide speed range, using a rheostatic source of power; (2) speeds selected easily by a potentiometer no larger than a standard push-button, mounted conveniently for the operator; and (3) equipment ideally suited for setting up an automatic sequence of operations.

Special Applications of Electric Control Devices

Perhaps the best way to demonstrate the versatility of electrical drives for machine tools is to mention briefly a few special applications. One of these is a large ship-propeller milling machine with tracer control. With this machine, it is possible to take the largest ship propeller yet built and accurately machine the desired contour on both sides of the blade by means of an electrical tracer mechanism. The same tracer mechanism is now being applied to smaller types of machines where it is desired to do contour machining accurately from either full size or scale models.

Another example of an electronic control is found on a fin type milling machine, designed to machine the fins on airplane-engine cylinder heads. The electronic drive is used to rotate the cylinder head and automatically regulate the speed of rotation, so that the cutter is removing metal at a constant rate, regardless of the depth of cut being taken. By using a simple load control circuit that measures the power input to the alternating-current motor driving the cutter, the electronic drive automatically regulates the rotation of the cylinder head, either speeding it up or slowing it down to maintain the cutter motor at full load and thus keep the cutter working at maximum efficiency. The addition of this relatively inexpensive electronic drive increased the output of this machine 30 per cent, and made it possible for two machines to do the work of three of the machines using the original constant-speed feed drive.

Still another interesting example is the application of a servo-mechanism to the feed drive of a large boring mill. This drive requires a total range of 1800 to 1, since a boring mill of this type must have its feed drive arranged for a given feed per table revolution. Large boring mills usually have the feed adjustable from 1/60 inch up to 1 inch per revolution of the table. The table speed is generally adjustable over a range of, say, 1/5 R.P.M. up to 6 R.P.M. This servo-mechanism results in a marked simplification in the mechanical drive, en-

tirely eliminating the need for a lineshaft drive from the table up to the column and across the rail. It also eliminates the elaborate speed-changing gear-box and the gear-shifting and clutch mechanisms employed on a large machine of this type.

Relative Merits of Electric and Hydraulic Drives

No attempt has been made so far to argue the relative merits of mechanical, hydraulic, and electric drives, but rather to point out that in all cases there is an electric drive used for the motive power of the machine, and to show how the electrical equipment can be expanded to perform some of the functions that in the past have been largely done with mechanical or hydraulic devices.

A round-table discussion of hydraulic versus electric drives was held at a former Westinghouse Machine Tool Electrification Forum, in which seven prominent machine tool designers took part. A comprehensive and fair summary of this discussion is as follows:

"One conclusion reached was that both types of drive have their fields of application, depending upon the kind of machine tool and the type of motion involved. In general, the hydraulic drive is considered better adaptable to reciprocating motions, such as certain planer tables and grinder tables, where short strokes and rapid reversals are encountered. An electric drive is less satisfactory in such cases, because of its higher inertia and probably greater space requirements for its control.

"On the other hand, electric drives lend themselves better than hydraulic drives to rotary motions, as, for example, in the case of spindles and feeds. It was developed that low efficiencies and leaky pipe lines constituted the charge against hydraulics. Hydraulic applications are limited by the compressibility of oil. Where the compression of oil in a cylinder or line is likely to give trouble, the advantages of the hydraulic drive may be offset by the troubles encountered. In the operation of clamps and indexing tables, hydraulic systems have a definite advantage because of the ease of cushioning to a stop, and an adjustable force can be brought to bear by merely adjusting a relief valve.

"The question of comparative space requirements also was debated. It was indicated that a hydraulic motor requires less space than an electric motor of equivalent rating. However, it was argued that while the electric motor of equivalent rating might be larger, one should not overlook the pump and its motor and the associated piping which constitute a part of the hydraulic system. 'It is easier to pull wires through a machine than it is to pull pipes,' one man stated. In this connection, it was brought out that to keep space requirements to a minimum with hydraulic drives, high pressures are used in many cases. With high pressures on the hydraulic motor, the system provides less overload rating than the electrical drive, which will carry overloads safely.

"Where feeds such as 0.002 and 0.003 inch per R.P.M. or 1/4 to 1/2 inch per minute are involved,

it was pointed out that an electric motor with tube control proved very satisfactory and resulted in the elimination of expensive reduction gears. However, it was argued that hydraulic systems can be used to obtain similar results, but care must be exercised in their application to precision tools. This is important because the heat generated in certain types of systems changes the viscosity of the oil, which results in variation of the feed rate. However, this has been overcome on some machine tools by the application of refrigeration.

"It was emphasized that, at present, each type of drive has its field of application, and that both hydraulic and electrical manufacturers have work to do—the former in the field of rotating motions and the latter in the field of reciprocating motions. In many cases, a combination of both drives provides the most satisfactory and most suitable arrangement.

"In the determination of the drive to be used on a machine, it would appear that the following points should be evaluated: (1) *Engineering*—Which drive lends itself to the design of the machine and fulfills all the requirements? (2) *Sales*—Will the machine with the selected drive sell on the market at a competitive price? (3) *Manufacture*—Does the selected drive lend itself easily to assembly in the machine with the available production facilities, and can it be produced quickly? (4) *Maintenance and Service*—Is the drive easily maintained and serviced by the user?"

* * *

Self-Propelled Turning Rolls Facilitate Automatic Welding of Tanks

Self-propelled turning rolls mounted on tracks are being used by the Struthers-Wells Corporation, Warren, Pa., to facilitate the automatic welding of tanks and other cylindrical work of various lengths and diameters. In making circular welds, the work is set on the turning rolls, as shown in the illustration, and rotated at the proper speed. In making longitudinal welds, the work is driven along the track underneath the fixed welding head.

The equipment consists of two units—power-

driven rolls and idler rolls, which are mounted on separate carriages. The power drive serves the dual purpose of rotating the work for circular welding and, by shifting a clutch, traversing the work, as required in longitudinal seam welding. The rollers are equipped with rubber tires to prevent bumping when longitudinal welds pass over them. Welding speeds of 7 to 57 inches per minute are provided for. This equipment was built by the Ransome Machinery Co., Dunellen, N. J.

* * *

New Applications of Molybdenum

Molybdenum is generally known to mechanical engineers as a metal for improving steels for cutting metal. However, this material promises to have many other uses in the mechanical industries.

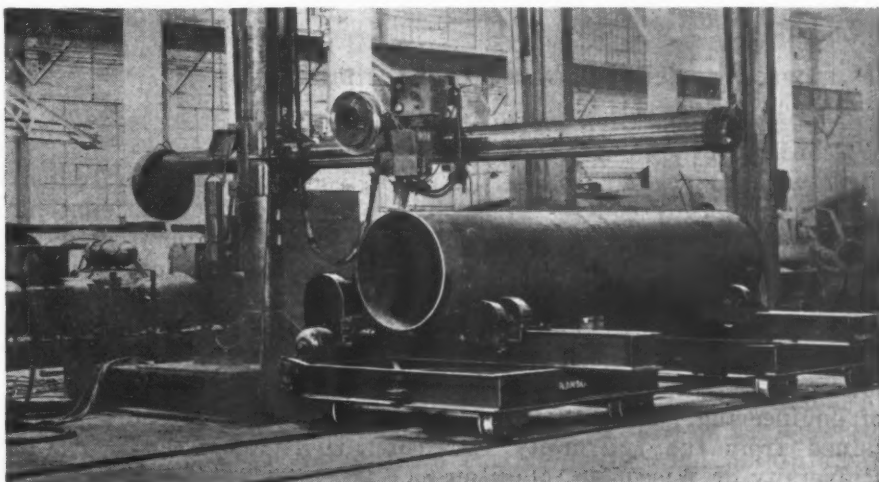
In the past, molybdenum could be produced only in the form of comparatively small diameter rods or wire, small-sized sheets, and a few other simple shapes of small dimensions. Recently, however, it has been produced in larger sizes and shapes, while the cost per pound has been reduced by about two-thirds. This makes the excellent properties of molybdenum available for a variety of uses.

Its most important properties are high melting point, high wear resistance, and resistance to high temperatures. It also has a higher modulus of elasticity, greater strength at high temperatures, and better thermal conductivity than steel. Furthermore, its specific heat and coefficient of expansion are lower than those of steel. The corrosion resistance of molybdenum compares favorably with such materials as tantalum, palladium, and platinum. It is expected that molybdenum will, in the future, be found useful as a material for small crucibles, electronic-tube filaments, welding alloys, and high-temperature engine parts.

* * *

One of the greatest obstacles to progress is the common characteristic of man to believe that because something has always been done in a certain way there is no better way of doing it.

Self-propelled Turning Rolls being Used to Facilitate the Circumferential and Longitudinal Welding of a Tank



Cutting Compounds for Machining Aluminum Alloys

The free-cutting aluminum alloys, such as Alcoa 173, C-113, 645, and B-113, are frequently machined without a cutting compound, especially in roughing operations. According to the Aluminum Co. of America, however, when heavy cuts and feeds produce excessive heat, a cutting compound may be used; often the type of compound that is essentially a coolant will be satisfactory. For this purpose, soda water or soluble oil is generally employed. In some instances, it may be desirable to add a small amount of lard oil or kerosene. This type of compound is widely used for milling, drilling, and sawing operations.

When the cutting compound must have more definite lubricating characteristics, the following recommendations are made:

1. There are a number of ready-mixed cutting lubricants intended for use in the form supplied by the producer. Most of these, however, are generally blended by the user with a low-viscosity mineral oil; the blend may be varied to suit different machining operations.

2. An excellent lubricant consists of equal parts of kerosene and lard oil; the proportions may be varied over a wide range for different operations.

With heavy cuts and slow feeds, such as for roughing and tapping operations, a cutting lubricant should be of high viscosity.

For automatic screw machine work, cutting compounds such as are used for other metals are generally suitable for aluminum alloys. There are a number of good commercial cutting oils prepared especially for use when machining aluminum in automatic screw machines. Usually, a light mineral oil with about 5 per cent of fatty oil additions, resulting in a compound with a viscosity of 56 Saybolt seconds at 100 degrees F., is employed. It is desirable that the cutting compound have a flash point of over 260 degrees F. An ample supply of cutting oil should be provided. A large volume of cutting compound flowing over the tool is more desirable than a high-pressure stream of smaller volume.

* * *

Correspondence Course in Mechanics

The Extension Division of the University of Wisconsin, through its department of civil and structural engineering, is offering two revised correspondence-study courses in mechanics for engineers, mainly for qualified students not attending schools of engineering. The aim of each is to afford a preparation in the principles of the subject and in their application to engineering problems. Each course embodies twenty-four assignments, and allows three credits toward a degree in any branch of engineering. Further information can be obtained from the University Extension Division, University of Wisconsin, Madison 6, Wis.

Safe Loading Chart Improves Truck Maintenance

A chart showing the safe loadings of plant industrial trucks has decreased accidents and improved truck maintenance at the South Philadelphia Works of the Westinghouse Electric Corporation. Previously, several trucks were out of service and accidents occurred due to overloading, improper loading, and incorrect handling of materials. Repair parts were difficult to obtain, and it became necessary to purchase additional equipment to compensate for the excessive time the trucks were spending in the repair shop.

A study of the problem indicated that many of the trucks were being overloaded, material was not stacked or piled properly, and accidents were happening to the trucks, requiring repairs. It was frequently difficult to determine the proper method of loading and the safe loads that could be hauled. This problem was given detailed study and resulted in the development of a loading chart showing the proper type of transportation equipment, the load of material which can be easily handled, and the correct type of block or skids required to handle the load safely during transportation. Since it was obviously impossible to cover the thousands of parts manufactured, representative items were chosen to give a reasonable distribution of sizes and shapes without including those special items for which skids and holding fixtures were provided before moving.

By showing representative items for a series of similar sizes and shapes, each item shown furnished the correct answer to a considerable number of similar parts, particularly since the identification and a picture of the part were given, and the total weight indicated. By making a general distribution of this chart to all supervisors, safety men, transportation department employees, and crane hookers-on, transportation in the shop has been very much improved. Where questions arise they can be quickly answered to the satisfaction of all concerned by reference to the chart, which is posted on the side of the truck. Repairs on transportation equipment have been reduced, hazards to other employees have been practically eliminated, and damage to finished parts seldom occurs.

* * *

Film on Industrial Air Power

"Our Industrial Air Power" is the title of a new educational film on the many industrial uses of compressed air, which is available for showing before students, engineering societies, and other groups. Among the sequences contained in this 25-minute, 16-mm., sound-color film are: "Fundamentals of Air Compression"; "Properties of Compressed Air"; "How Different Types of Compressors Work"; and "How Compressed Air is Used." The film is available on a loan basis from the Quincy Compressor Co., Quincy, Ill.

Friction Band-Sawing of Hard Materials

By CHARLES H. WICK

THE principal difference between friction and conventional band sawing is in the speed of blade travel, the friction band-saw blade traveling up to nearly 3 miles per minute. While the ordinary saw cuts chips, the dry friction saw blade develops enough frictional heat in the cut to soften the material, and the teeth of the blade carry this softened material out of the cut. Fig. 1 shows a deposit of metal that was formed on the lower wheel guard from friction sawing.

With friction sawing, more heat is required to saw thick sections of a material than thin sections. The additional heat is obtained by increasing the saw-blade velocity. This is the exact opposite of the practice followed in conventional sawing, where the velocity of the blade is reduced as the thickness of the material being cut increases. An infinitely variable speed control supplied on some friction sawing machines provides blade velocities of from approximately 3000 to 15,000 feet per minute, and enables speeds to be regulated to suit materials of various thicknesses. The correct saw-blade velocity for different thicknesses of several materials was tabulated in the article "Friction Cutting of Metals by Band Saws," published in the October, 1945, number of *MACHINERY*, page 188.

Owing to the high speed of the blade, the heat created by friction between the blade and the work is confined to a very small area, immediately ahead of the saw and on each side of the kerf. The amount of heat created depends on the heat transfer characteristic of the material being sawed. The in-



creased hardness of the sawed edge of the material due to this heat is usually negligible, but in certain cases may be effective to a depth of approximately 0.003 inch. Use of the correct saw blade is important in minimizing heat penetration. In cases where the piece being sawed is to be profile milled subsequently, it is good practice to anneal the piece before the milling operation, in order to increase the life of the milling cutters.

Band saw blades without teeth have been used for friction cutting, but it is obvious that bands with teeth are more efficient, since the softened material is readily carried off from the kerf, resulting in a smaller burr. Blades from 1/4 to 1 inch wide, and of 10, 14, and 18 pitch are recommended. Proper spacing of the teeth is important, because if the teeth are too close together, there is a tendency for the blade to become loaded. Coarser-pitch blades are required for thicker sections when sawed at a higher velocity.

As thicker sections are sawed, greater feeding pressure is required, and consequently wider saw blades are necessary to withstand increased edge thrust. This increases the minimum radius that can be effectively sawed. A hydraulic feed table is sometimes utilized for feeding heavy sections or hard materials to prevent fatigue of the operator, assure uniform cutting speed, and obtain faster

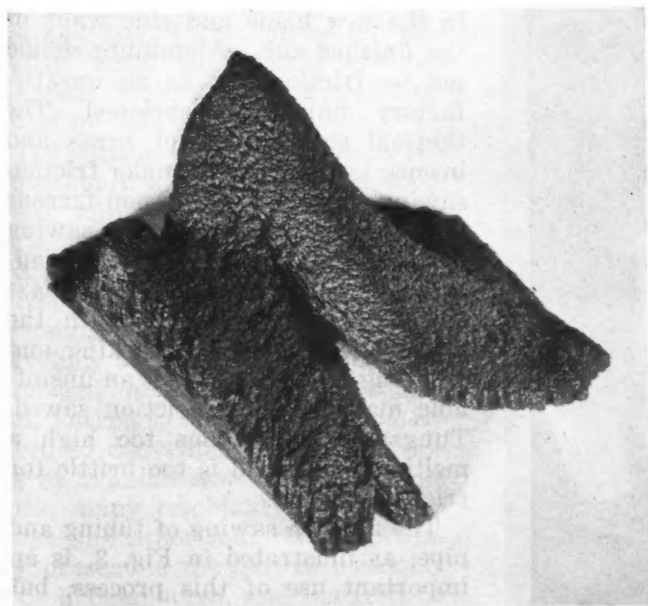


Fig. 1. Metal Deposit Removed from Lower Wheel Guard of Friction Band-sawing Machine



Fig. 2. Trimming a Bus Fender by Friction Sawing

rates. Tooth sharpness is not important; in fact, a dull blade creates more friction, thus increasing the allowable sawing rate. An emery stone held against a new saw blade knocks off the sharp points and actually produces a faster cutting blade.

Saw blade life varies widely from hours to weeks, depending on the radius of the corner being cut, sawing rate, and type of material being sawed.

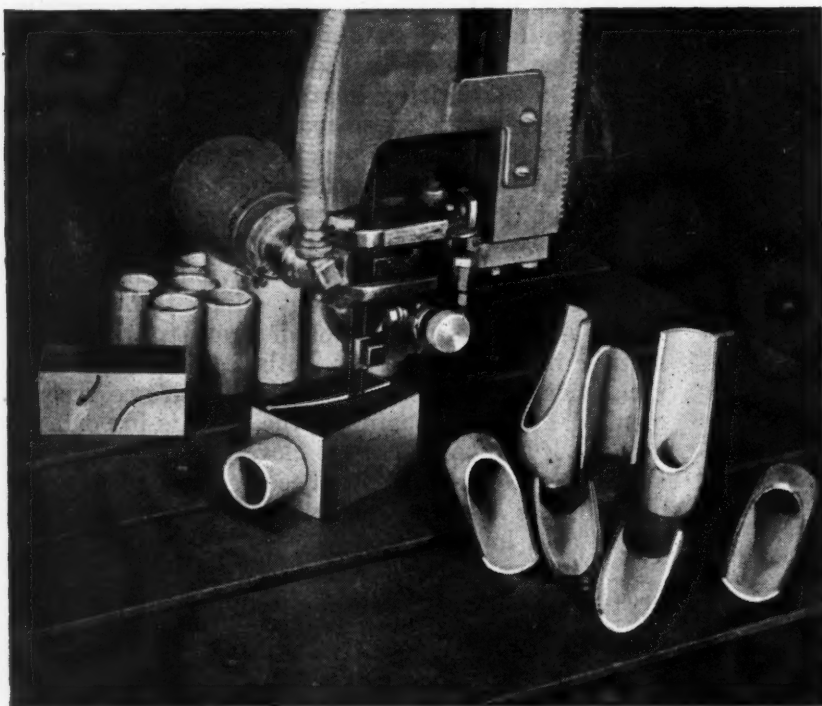


Fig. 3. Stainless-steel Pipe is Rapidly Sawed in the Simple Steel Block Fixture Shown

Heavy sections having high ductility and small radii, and silicon-coated castings substantially reduce saw blade life.

Intricate contour cutting work on irregular-shaped ferrous materials is advantageously handled by friction sawing. Automobile fenders, doors, dashboards, etc., are easily trimmed to irregular lines. Fig. 2 illustrates the friction sawing of bus fenders, which were completely trimmed in 1.7 minutes, with only a slight burr, at a saw velocity of 6500 feet per minute.

Friction sawing must be done on single sheets or shapes. Stack sawing is not practical because the softened material has a tendency to cause a welding action between the sheets.

Friction sawing of hard steel is usually limited to material having a thickness of approximately 1 inch. Thicker sections of hard steels, such as armor plate, can be friction sawed by using a "rocking" technique. This consists of tilting the work slightly so that only one corner is presented to the saw blade teeth. When the saw blade begins to cut, the work is lowered and raised alternately, presenting a point to the saw blade at all times, and keeping the heat concentrated. This technique applies only to hard steels, as other materials need no special handling, and can be cut in thicknesses up to the capacity of the machine.

In friction sawing, as well as in conventional low-speed cutting, the mark made by the saw blade teeth varies from a pronounced shallow scratch to one scarcely visible to the naked eye. A thin and easily removed burr, from 1/32 to 1/16 inch high, forms on the under side of the cut on all steel that is friction sawed.

Most steel alloys lend themselves to friction sawing. There are exceptions to this rule, however; for example, certain materials only burn when heat is applied to them, and other materials soften and become sticky, adhering to the saw blade and side walls of the finished cut. Aluminum should not be friction cut, as an unsatisfactory finish is developed. The thermal conductivity of brass and bronze is too high to make friction sawing applicable. Other non-ferrous materials to which friction sawing is not applicable, include magnesium, copper, Kirksite, etc. Glass softens at point contact with the saw blade, but radial cracking and chipping occur, making it an unsuitable material to be friction sawed. Tungsten carbide has too high a melting point, and is too brittle for friction cutting.

The friction sawing of tubing and pipe, as illustrated in Fig. 3, is an important use of this process, but it is limited by the wall thickness in relation to the outside diameter of the tubing. The maximum work

thickness capacity is approached as the saw blade breaks through the inner wall.

The following data on the friction sawing of various materials and sawing rates are based on laboratory and field tests made by the DoAll Co., Minneapolis, Minn.: Solid round stock up to 1 inch diameter can be friction cut. The friction band-sawing of tubing 1 1/2 inches in diameter is limited to a wall thickness of 1/4 inch; 2 inches diameter, 5/32 inch thick; 2 1/2 inches diameter, 7/64 inch thick; 4 1/2 inches diameter, 5/64 inch thick; 8 1/4 inches diameter, 3/64 inch thick; and 12-inch diameter, 1/32 inch thick. Tubing with an outside diameter of 2 inches and a wall thickness of 3/32 inch can be cut off at the rate of 33 pieces per minute.

Fig. 3 shows the friction sawing of stainless-steel pipes, 1 7/8 inches outside diameter by 1 5/8 inches inside diameter by 4 inches long. The transverse cuts were made in 0.06 minute using the simple steel block fixture shown.

Armor plate can be cut freely by friction sawing. A 3/4-inch thickness of armor plate can be cut at the rate of 13.84 linear inches per minute, using a 1-inch wide, 10-pitch saw blade operating at a speed of 15,000 feet per minute. A 1-inch thickness of stainless steel can be cut at 10 linear inches per minute, using a 1-inch wide, 14-pitch saw blade at a speed of 15,000 feet per minute. A 1/2-inch thickness of S A E 1095 steel, having a Rockwell hardness of 70 on the 30T scale, can be cut at 35 linear inches per minute, using a 1-inch wide, 14-pitch saw blade at a speed of 13,000 feet per minute. No. 20 gage lead-coated sheet steel can be cut at 633 linear inches per minute using a 3/4-inch wide, 14-pitch blade at a speed of 6000 feet per minute. Hastelloy can be friction sawed, as shown in Fig. 4, at the rate of 3 linear inches per minute using a 10-pitch, 1-inch wide blade at a speed of 15,000 feet per minute. Ferrous castings can be friction sawed efficiently when thicknesses are not too great. Welded sections are easily sawed by this method.

The salvage of tools, such as the reduction in width of damaged high-speed milling cutters, is an important friction-sawing application. Fig. 5 shows the smooth finish imparted to a high-speed steel milling cutter by a friction band-saw blade traveling at 9000 feet per minute. Damaged airplane wing sections, dies, castings, etc., can also be reduced to convenient sizes for melting by friction sawing. In salvage work, many combinations of metal alloys and other materials are usually present in the part or assembly to be dismembered, and the friction band-sawing machine is convenient for this work, as it is able to cut practically all these materials.



Fig. 4. Trimming Hastelloy at 3 Linear Inches per Minute

Gear Industry Reports Increase in Sales

The gearing industry, as represented by the members of the American Gear Manufacturers Association, reports an increase in the volume of sales for March, 1946, of 8.7 per cent, as compared with the previous month. This report does not include turbine or propulsion gearing.

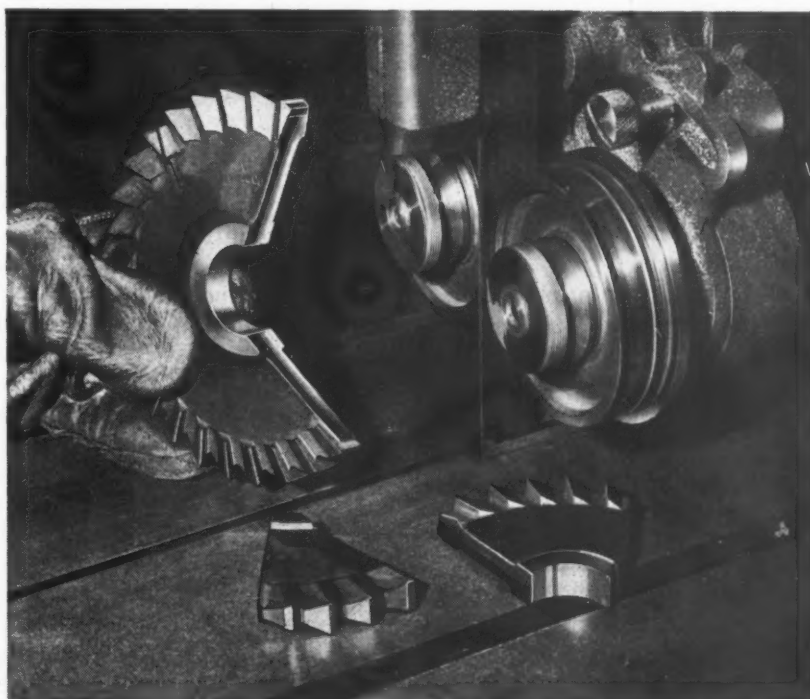


Fig. 5. Friction Saw Gives a Smooth Finish in Salvaging High-speed Steel Milling Cutter

Some Considerations in Internal Grinding

GRINDING probably introduces more governing factors than any other machining operation—the material being ground; amount of stock to be removed; accuracy and finish required; diameter of work in relation to wheel; speed, grit, grade, and bond of wheel; rigidity of machine; and in-feed and traverse speeds. All these factors have an influence on the rate of production and the finish of the ground work. Additional factors are introduced in internal grinding, especially when the holes ground are of small diameter, be-

found more satisfactory than the use of high speeds with a softer wheel.

Mounted wheels are used for very small bores. Except in special cases, however, they should not be employed on sizes above 3/16 inch in diameter, because not only are they more expensive, but the wheel is easily broken away from the shank, thus requiring frequent replacements.

Varying the work speed does not have the same effect in internal grinding as in external grinding because, as may be easily understood, a 3/8-inch diameter bore requires a very wide variation in peripheral speed to produce a substantial change of surface speed. Furthermore, the arc contact between the wheel and the work also remains fairly constant, the wheel usually being changed to suit the diameter of the bore. Work speeds between 150 and 200 feet per minute will usually be found most satisfactory.

The following rules are suggested for making changes in grinding wheel and work spindles to suit individual work: (1) Reducing the grinding wheel speed is equivalent to using a softer wheel. (2) Increasing the work speed is equivalent to using a softer wheel. (3) The harder the material, the softer the wheel required. (4) The larger the wheel or the closer the grinding wheel diameter is to the diameter of the hole being ground, the softer the wheel required. (5) The higher the traverse speed, the harder the wheel required. (6) An interrupted bore surface, such as a bore with a keyway, requires a harder wheel. When making changes in speed to suit the work, it is preferable to alter the work and traverse speeds rather than to lower the spindle speed, and in any case, it is usually more convenient.

Three types of wheel-heads for holding grinding wheels are normally used for the internal grinding of small holes: (1) The removable quill type, Fig. 1, in which the quill size can be varied to suit the work. This type is used when a large variety of work is handled. (2) The solid spindle or "naked" style, in which the wheel is mounted directly on the end of the spindle extension. This type is suitable for maximum production on one size of hole, or at least a limited range of bores. (3) The sleeve type, Fig. 2, for grinding larger diameters and long bores. This type has bearings immediately in back of the wheel, resulting in maximum rigidity, especially for long bores, and is also suitable for face grinding. It is false economy to expect one size of grinding spindle to cover a wide variety of work, except for tool-room operations when maximum production is not the first consideration.

One of the most important points in high-grade internal grinding is correct lubrication of the spindle. A good quality of light spindle oil must be used. A surprising number of spindles are ruined,

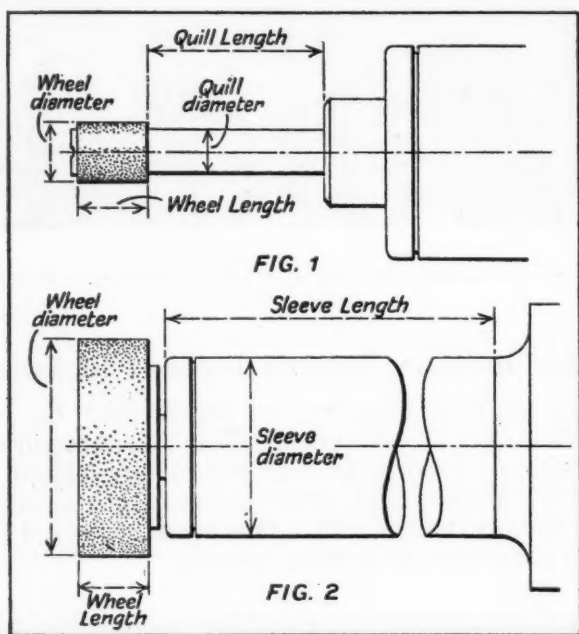


Fig. 1. Quill Type Spindle for Internal Grinding.

Fig. 2. Sleeve Type Spindle for Grinding Long Bores of Large Diameter

cause for this work very high peripheral grinding wheel speeds are necessary to obtain the required surface speeds.

The usual recommendation for a surface speed of from 5000 to 6000 feet per minute would, in small holes, require a higher spindle speed than is generally practicable. For example, a 3/8-inch diameter wheel would have to be driven at approximately 50,000 R.P.M. to obtain this surface speed. While such speeds are not impossible, a very light grinding spindle is required, and it is difficult to obtain the necessary rigidity.

Tables have been prepared giving quill sizes and maximum quill lengths for given grinding wheel sizes. So many factors are involved, however, that figures from a table cannot be applied to all applications, but can merely be used as a working basis. Generally speaking, for the grinding of small bores up to 3/4 inch in diameter, the use of a fairly low surface speed with a fairly hard wheel has been

or their efficiency impaired, by the use of improperly selected oil. In one plant, it is customary to paint oil-cans containing spindle oil with a distinctive color.

Another common cause of failure on some types of wheel-heads is over-tightening the spindle in its bracket. It should be clamped very lightly, with just sufficient tension to prevent the spindle from moving. The slight distortion caused by over-tightening puts an excessive strain on the bearings, with consequent rapid failure, due to the very high speeds at which the spindles operate. The spindles should also be a good fit in the bracket, so that complete contact is obtained. This, of course, does not apply to spindles that are fitted to the machine as a unit, or to those wheel-heads with two-piece body and tapered bearing sleeve construction.

Care should be taken to use high-grade belts that run as nearly true as possible. An inferior belt can cause a surprising amount of vibration at the high speeds used, and this is transmitted almost directly to the wheel and work.

* * *

Training Supervisors in Human Relations

Increased emphasis on the human factor in modern relations is reflected in a new report, "Training Supervisors in Human Relations," recently issued by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co. The study is designed to assist business organizations in developing supervisory skill in human relations, and is based on the practices of thirty-nine companies that have developed training programs. The material covered includes organization, development and training methods, subjects dealt with in training programs, and leadership qualifications of the supervisor. An appendix includes a training program proposal, a training outline, and a case study used in a conference.

A limited number of these reports are available to executives without charge. Requests should be addressed to the Policyholders' Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York 10, N. Y.

* * *

According to the book "Steel in the War," published by the U. S. Steel Corporation, a total of 455,400 motor vehicles—trucks, armored cars, jeeps, and motorcycles—were shipped to Russia under Lend-Lease during the war. In addition, the United States shipped to Russia 14,500 military planes, 1500 locomotives, 10,900 freight cars, 546,000 tons of rails, and 116,000 tons of railroad wheels and axles. We also supplied the Soviet forces with 8200 anti-aircraft guns, 135,000 sub-machine guns, 105 submarine chasers, 7600 marine Diesel engines, 343,000 tons of explosives, and 47,700,000 square feet of airplane landing mats.

Silicone Insulation for High Temperatures

About two years ago, silicone insulation was introduced. Its high-temperature characteristics were quite unusual. All its possibilities have not as yet been evaluated, but it is quite certain that silicone is an insulation of unusual value. It is made by the Dow Corning Corporation, and has been applied to electrical apparatus by the Westinghouse Electric Corporation.

When this material was first developed, direct-current and induction motors were equipped with silicone-impregnated insulation, such as glass tape, mica, asbestos, etc., for testing purposes. These motors were then placed on test stands and run under severe tests of load and temperature. Each run at some selected high temperature was followed by a shut-down and severe humidification. The tests are still being carried on. No failures have been recorded, although some induction motors have operated for a total of 4000 hours at 580 degrees F. In addition to its high temperature stability, this insulation has remarkable ability to resist moisture, even under the adverse conditions of combined humidity and great changes in temperature.

It is not expected that silicone will replace the generally used organic varnishes in the immediate future, as it is still too expensive. Silicone varnishes cost about \$15 a gallon, which is from seven to ten times the cost of other good varnishes. Also, the baking temperature for silicone-treated insulations is about 180 degrees F. above that for ordinary varnishes, and the ovens in most motor repair shops cannot provide such high temperatures.

There are, however, many applications for which this insulation seems exceptionally well suited. When a reduction in size or an increase in output of a rotating electrical machine is desired, or when ambient temperatures are high and the temperature is the limiting factor, this insulation answers the requirements. It is particularly useful when it is desirable to enclose motors, as in street railway service, and is also well suited for powerhouse auxiliary motors that must run in hot atmospheres.

To indicate the value of this insulation, it might be mentioned that a marine motor in a cramped location developed 3200 H.P. with ordinary high-temperature insulation, whereas with silicone insulation it developed 3900 H.P.—an increase of almost 25 per cent. Silicone insulation may also prove useful for non-rotating apparatus, such as air-cooled transformers, capacitors, and dashpots.

* * *

According to the pattern for German industry which was recently announced in Berlin, that country will not be allowed to produce any heavy machine tools, and on lighter types of machine tools the industry will be held to only 11.4 per cent of its 1938 production.

Coated Abrasives Solve Many Reconversion Metal-Finishing Problems

MANY small but important finishing operations in metal manufacturing plants are now being performed with rotating tools that utilize war-born coated abrasives. Through the use of these tools, an appreciable saving in time has resulted on various jobs. A considerable amount of experimentation in the application of coated abrasives for war work has been carried through by the Behr-Manning Corporation, Troy, N. Y., into the cost-cutting period of reconversion. A few examples indicating the character of these developments will be referred to in this article.

The effectiveness of these applications has been attained, not by the development of new forms of coated abrasives, but rather by finding new methods of bringing the abrasive into contact with the metal surfaces to be rounded or smoothed.

One small and simple operation—that of finishing the walls and corners of small holes in metal parts—will serve as an example of the kind of work for which coated abrasives are especially suitable. A typical job of this kind requires the removal of burrs, polishing the inside, and converting the sharp edges on both front and back of each hole to a smooth radius. This was formerly done by hand, and required one minute for each hole. A reduction in time was wanted without resorting to elaborate equipment. The final solution was simplicity itself. Two strips of abrasive cloth, 1 inch long by 1/4 inch wide, were threaded through

the eye of an ordinary darning needle. When placed in a high-speed rotating tool-holder, it was found that a radius could be cut on the front and back edges of the hole and the cylindrical wall portion smoothed by a single pass through the hole and back again. Using this method, the time was reduced to fifteen seconds.

Similar applications have been developed by experimentation with various coated abrasive devices for finishing larger holes of different diameters. By using round disks of abrasive cloth which have straight radial slots around the circumference, it has been found possible to burr holes ranging from 1/2 inch to 5 inches in diameter in sheet metal, and to burr and polish holes in machined parts such as valve rocker-arms, connecting-rods, valve tappets, and oil-holes having openings larger than 7/16 inch. An example of this use of slotted abrasive disks is shown in Fig. 1.

If the hole is blind, a single disk is mounted on the mandrel with the grit side toward the work. If the hole is open, two disks are mounted back to back. These, when passed completely through the hole and back again, will burr and put a radius on the edge of both openings and also will polish the inside. Should the inside of the hole have a honed or other final finish, a single disk is used. This is flexed into the opening only far enough to remove the sharp edge and give the desired radius.

When larger openings are to be finished, the

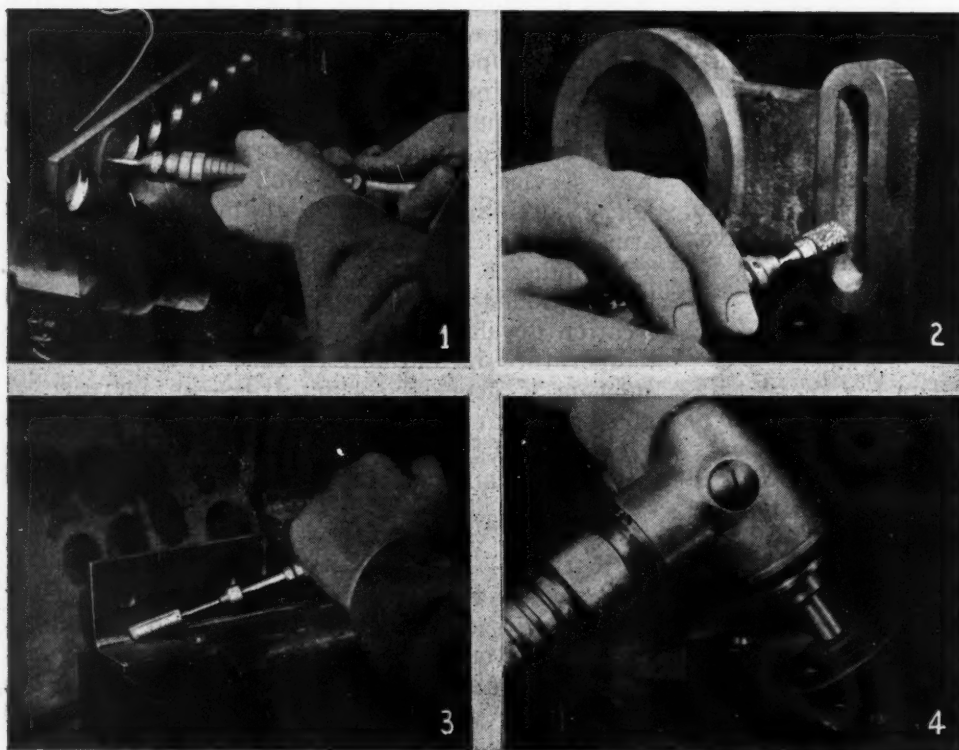


Fig. 1. Slotted Abrasive Disks Provide a Rapid Means of Finishing the Edges and Walls of Holes in Metal Parts. Fig. 2. A Rubber Expanding Mandrel Fitted with an Abrasive Cloth "Spiraband" Makes an Excellent Tool for Burring and Rounding Sharp Edges. Fig. 3. Using an Abrasive Cloth Pencil for Polishing Fillets of Welds. Fig. 4. Rubber Sanding Pad Used for Polishing Drawing Dies

necessary back-up pressure for the abrasive disks is obtained by cutting suitable disks of canvas, duck, rubber sheeting, or similar flexible material. The diameter of the supporting disks is smaller than that of the abrasive disks, the difference being determined by the amount of pressure required.

If, for example, a piece of tubing that is open at both ends is to be finished, this arrangement may be utilized. Thus, it is determined that a No. 36 grit disk will remove the tool marks, but a No. 60 or a No. 80 grit is required to give a satisfactory finish. The slotted disks of No. 60 or No. 80 grit are mounted with the grit side away from the work. Then the backing-up disks are placed on the mandrel, and finally disks of No. 36 grit are mounted with the grit side toward the work, as shown in Fig. 5. As this coated abrasive assembly passes through the hole, the coarser grit removes the tool marks and as it is withdrawn, the finer grit performs the polishing operation.

By using an expanding rubber mandrel and fitting a band of abrasive cloth tightly around it, such internal and external finishing jobs as shown in Fig. 2 can be rapidly and effectively handled. Similar in appearance are the abrasive cloth pencils. A split mandrel can be used for these, and the length of the abrasive strip varied to suit the job. For internal finishing, no fastening arrangement is necessary. For external finishing, a piece of tape is used to bind the pencil after it has been wound.

In Fig. 3 is shown a factory-made glued pencil used on a threaded mandrel. Some of these pencils are glued throughout their length, and others are glued for one-third the distance from one end only. This particular tool is indispensable for finishing corners and cross-sections ordinarily inaccessible to other types of tools. An example of the use of such tools is shown in Fig. 3, where a welded fillet is being polished.

For smoothing the curved metal surfaces of drawing dies, a tool consisting of 3-inch molded

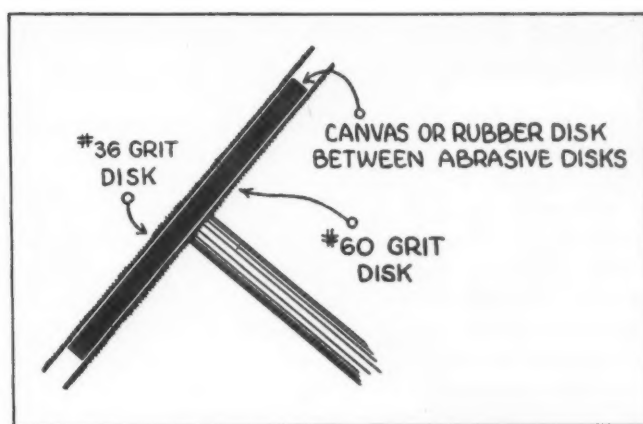


Fig. 5. For Parts Having Fairly Large Holes to be Finished, Two Slotted Abrasive Disks, Supported by Canvas or Rubber Backing, Will Remove Tool Marks and Polish the Interior of the Hole

abrasive cloth disks, mounted on a flexible rubber head called a "mushroom sanding pad," has proved of exceptional value and versatility. The construction of this tool is indicated in Fig. 4.

All the tools referred to make use of aluminum-oxide abrasive cloth. Generally, the tools or mandrels are developed and made by the consumer, himself, who has a difficult grinding or finishing problem to solve. The experience of the Behr-Manning Corporation, however, is often drawn upon by the users. This company has cooperated in solving many problems of this kind throughout industry, and has supplied advice and blueprints in many cases where the user may not have had sufficient experience in this kind of work to find his own solution.

The development and introduction of these special coated abrasive tools brought industry-wide endorsement during the war, and new cost-cutting applications are constantly being found for them in the solution of reconversion finishing problems.

The Automotive Industry Stages Fifty-Year Celebration

FIFTY years ago—in the summer of 1896—the first automobile was sold in this country, and an industry came into being that was destined to become one of the greatest in the United States and throughout the world. To celebrate the fifty years of remarkable growth and development of this industry, the city of Detroit is holding an Automotive Golden Jubilee from May 31 to June 9, inclusive. A series of events is being staged, including parades, a tribute to the pioneers of the industry, pageants, festivals, and an antique automobile exposition. Incidentally, Detroit is simultaneously observing the one-hundred-fiftieth anniversary of the raising of the American flag over that area.

During the fifty years of its existence, the automobile industry has produced over 90,000,000 cars

and trucks, costing \$64,000,000,000. It is now a \$4,000,000,000 industry, outranked only by the food and clothing industries. In the United States alone, there are 30,000,000 motor vehicles in use, operating on 1,400,000 miles of highway. Almost half of all the communities in this nation are served only by highway and motor car. It is clear that the automobile has had a profound effect on our economic, social, political, cultural, and religious life during these first fifty years.

* * *

The man who is too important to do insignificant jobs is likely to find himself without significant jobs to do.

Some Points to be Considered in Selecting Drawing Lubricants

In an article entitled "Easing the Draw," in *The Houghton Line*, published by E. F. Houghton & Co., Philadelphia, Pa., emphasis is placed on the use of a sufficient amount of lubricant in metal-drawing operations. Insufficient lubrication is likely to cause waste of power in overcoming friction, scoring or fouling of the work, or loading of the dies. An inadequate supply of lubricant will also cause an uneven draw. It is false economy to apply any drawing compound in a niggardly fashion.

One of the important considerations in the choice of drawing lubricants is the film strength of the lubricant. A plentiful supply of lubricant of low film strength will not, as a rule, give as good results as a smaller quantity of a compound having a sufficiently high film strength. Some materials do not need as high a film strength as others. Brass, for example, does not require the film strength that steel does. The fact that the material being drawn influences the type of compound required should not be overlooked.

Another feature to be considered is the tendency of the compound to react chemically with the work. The action of sulphur on brass and of alkalis on zinc may be cited as examples. Alkaline residue on the work roughens the surface and forms abrasive compounds which may result in an increase in friction, greatly hampering the ease with which the drawing operation can be performed.

In no case should straight lubricating oils or greases be considered effective drawing compounds; they are rather carriers for those other elements that are necessary to do a good job. No single compound can be used with equal effectiveness on all types of drawing. Experimentation and the advice of a lubrication service engineer are necessary.



Results of Ten-Year Aging Test of Neoprene

Results of a ten-year test to determine how various formulations of Neoprene would withstand the effects of sunlight and weather have been announced by the du Pont Co. In these tests, compositions of high-quality Neoprene and compounds of natural rubber were exposed, under strain, to the weather for ten years and seven months. Natural rubber cracked so extensively that it was reported to be totally unfit for service. Neoprene showed practically no signs of deterioration.

Absence of surface cracks on the Neoprene compound made it possible to subject the sample to tests of its physical properties. At the end of the ten-year period of outdoor exposure, the Neoprene composition retained 72 per cent of its original tensile strength and 85 per cent of its original elongation value. The tests showed that the rate of change in the tensile strength of Neoprene during the first five years of exposure was greater than that observed during the second five years. Outdoor exposure of an elastic compound in a strained condition is one of the most severe tests encountered in service.

* * *

Honing Wheel Facilitates Finish-Sharpening of Carbide Tools

The carbide-tool dressing equipment shown in the accompanying illustration allows the operator to finish-hone his tools with one stroke across the inner honing wheel immediately after rough-grinding or semi-finishing on the outer wheel. With this arrangement, time is saved by using the same protractor set-up for rough-grinding and finish-honing. This eliminates the necessity for hand-honing or grinding on special carbide-tool grinders.

The honing wheel is manufactured by the Precision Diamond Tool Co., 102 S. Grove Ave., Elgin, Ill., and is intended to be mounted on the inside of a 6- or 7-inch diamond cup-shaped wheel such as is used on standard carbide-tool grinders. It can, however, be mounted on the inside of any wheel or on any make of grinder.

Finish-sharpening a Carbide Tool on a Honing Wheel which is Mounted on the Inside of the Rough-grinding Wheel

Suggested Industrial Legislation

In an address before the Philadelphia Section of the Pressed Metal Institute, Lawrence B. Morris made the following suggestions with regard to legislation necessary to improve industrial relations between employer and employee:

Legislation should make it unlawful to strike against Government authority or to coerce the Government. Within proper limits, it should be unlawful to strike in order to compel economic waste, such as preventing technological improvement, or to prevent or restrict the use of the products of industry. Legislation should impose on all parties alike the obligation to perform lawful contract provisions, and should deny the privileges of collective bargaining to those who do not; should impose legal and individual responsibility on employees for engaging in, or coercing others into doing, acts which are made unlawful, as in the case of strikes against an employer who refuses to violate a binding Government law or order; should make it unlawful for anyone to interfere with the right of any citizen to work, and safeguard every man from violence or molestation in the exercise of that right; should provide that all citizens, individual or corporate, stand equal before the law, and eliminate all present immunities and special privileges enjoyed by specified persons or organizations; should prohibit contributions or expenditures by any industrial or labor organization for any candidate for public office, or for political activity; and finally, should provide for judicial review of decisions by the courts.

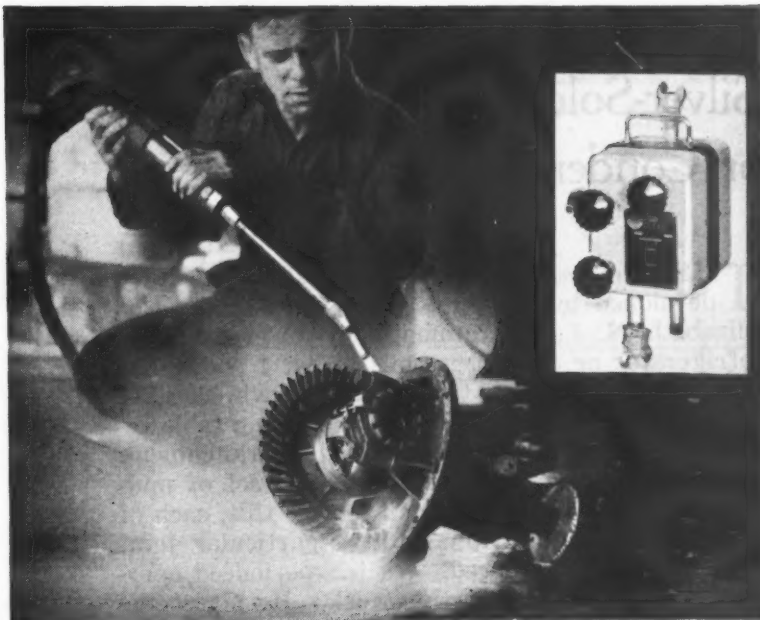
* * *

Machine Design Group of A.S.M.E. to Hold First Technical Session

The first technical session of the newly formed Machine Design Group of the American Society of Mechanical Engineers will be held on the afternoon of June 17 during the semi-annual meeting of the Society at the Hotel Statler in Detroit. The papers scheduled for this session are: "Application of Tables for Helical Spring Design," by H. F. Ross, United Shoe Machinery Corporation, Beverly, Mass.; "High-Speed Chain Developments," by A. W. Meyer, Brown & Sharpe Mfg. Co., Providence, R. I.; and "Evaluating Self-Locking Nuts for Industrial Equipment," by William E. Horenburger, Elastic Stop Nut Co. of America, Union, N. J.

* * *

Most accidents are avoidable. Don't gamble with danger; too many have tried it and lost.



Cleaning Dirt and Grease from an Assembly with a Portable Hydro-steam Unit that Weighs Only 28 Pounds

Portable Steam Cleaning Unit

A hydro-steam unit that weighs only 28 pounds but gives an effective cleaning action through the use of heat, water, detergent, and friction is shown in the accompanying illustration. Because of its light weight, this unit can be easily applied for cleaning work in various locations throughout the shop. Quick-acting couplings permit fast connection to any steam line with a pressure of 80 to 150 pounds per square inch and a 3/4-inch valve outlet.

Three manual controls adjust the temperature, the quantity of solution delivered, and the nozzle pressure to meet the requirements of the job at hand. A high-temperature penetrating spray or a moderately warm spray can be supplied. This unit is a development of Turco Products, Inc., Los Angeles, Calif.

* * *

Increase in Industrial Efficiency Paralleled in Farming

In a statement made by Louis Ware, president of the International Minerals & Chemical Corporation, it was pointed out that mechanization, research, and intelligent use of plant foods made it possible for 7,000,000 fewer American farmers and farm workers than there were ten years ago to produce, in 1945, approximately 25 per cent more foodstuffs. What can be done through better knowledge of all the factors involved in farming is evidenced by the fact that, in 1943, American farms produced over 500,000,000 more bushels of corn than in 1929 on 3,350,000 fewer acres. This raising of farming efficiency to parallel the increased efficiency in manufacturing makes possible a balanced development of the country's economy.

Automatic Arrangement for Silver-Soldering Refrigerator or Condenser Coils

THE accompanying illustrations show a method developed by the American Gas Furnace Co., Elizabeth, N. J., for automatically silver-soldering refrigerator or condenser coils. Fig. 1 shows the entire arrangement of the equipment, while Fig. 2 shows a close-up view with the protecting table removed, so as to clearly illustrate the arrangement.

Briefly, the equipment consists of a set of multiple burners with many small burner tips, each of which is aimed individually at a particular joint in the coil to be soldered. An inexperienced operator can easily perform this work. He places the coil in front of the burners and simply presses a timer button, which causes the flame to play upon the joints being soldered for a certain predetermined length of time. At the end of this period, the flame is automatically shut off.

The condenser coil, as will be noted in Fig. 1, can be moved or indexed along the supporting table to bring different joints into the proper position in front of the flames. In the particular unit shown, there are thirty-two joints in 5/16-inch copper piping. The entire unit can be silver-soldered in forty seconds, so that approximately sixty pieces per hour can be soldered by one operator. This is accomplished with small gas consumption—not exceeding 250 cubic feet per hour, costing about 2 1/2 cents. Blower air at 1 to 2 pounds pressure per square inch is also supplied.

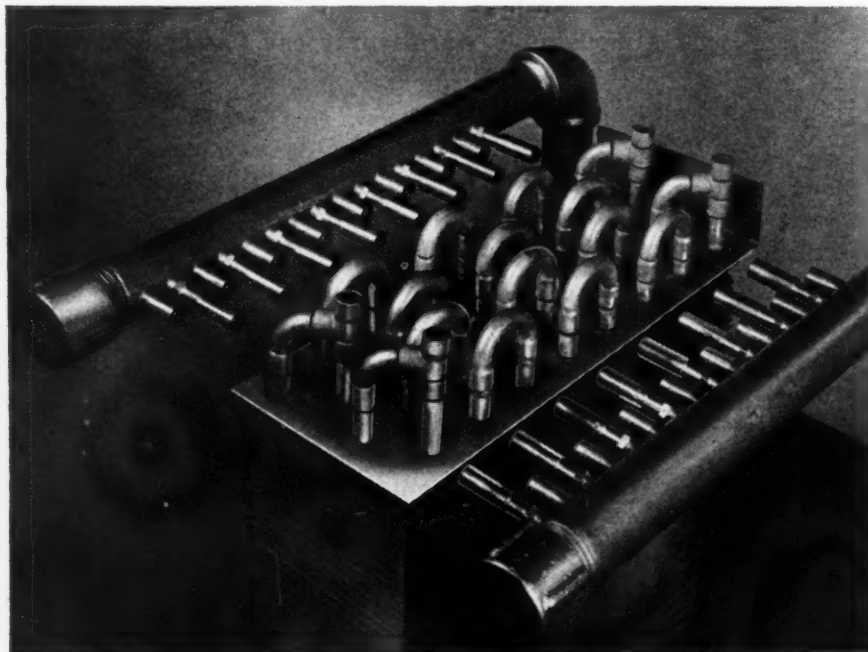


Fig. 2. Close-up View of Equipment, Showing Burners and Joints to be Silver-soldered. Thirty-two Joints are Soldered in Forty Seconds

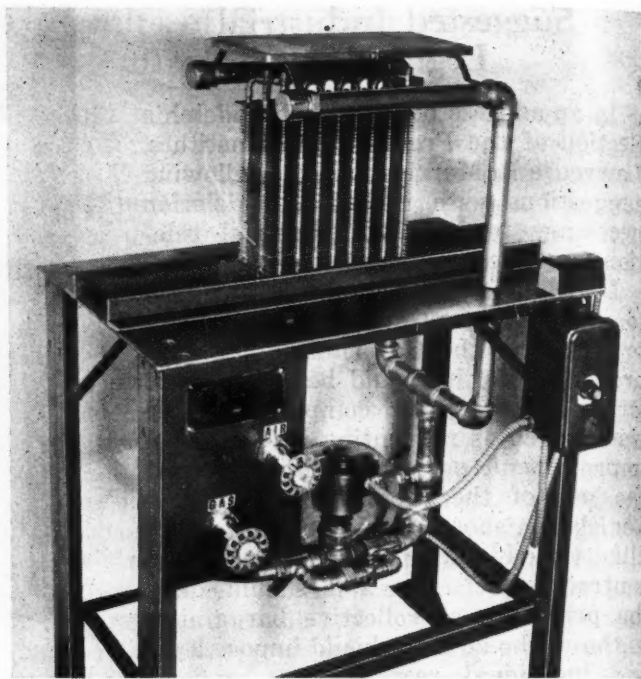


Fig. 1. Equipment for Automatically Silver-soldering Refrigerator or Condenser Coils

Compared with this, the rather slow method of using an individual oxy-acetylene torch takes about eight minutes, at a considerably greater cost for gas, and also requires a skilled operator, with less guarantee that all joints will be perfect.

* * *

American business has had a strange history. It is a composite of inventive genius, hard-fisted planning, sheer gambling and playing hunches, producing in mass, creating new desires, and "hit and miss." Most businesses have missed. Only the strong—and they are a very small minority—have survived. But somehow, out of its spotty record, American business has accomplished something which has not been done anywhere else: It has given the world's highest quality, at the world's lowest prices, while paying the world's best wages.—*E. T. Leech, Editor, The Pittsburgh Press*

* * *

There is a distinction between recognizing a fault or deficiency and criticism. One should not criticize unless one can suggest a better way; but to recognize a fault or a deficiency in a method is merely the first step on the road toward improving it.

Equipment Designed to Facilitate the Use of Diamond Tools

By Dr. G. SCHLESINGER and Dr. D. F. GALLOWAY
Research Department, British Institution of Production Engineers

GENERALLY the best results are obtained with diamond tools when provision is made for adjustment of the holders about three mutually perpendicular axes. The various effects of rotation about these axes are indicated in Fig. 1. It is clear that rotation about axis $X-X'$ affects side rake and side relief; about axis $Y-Y'$ back rake and end relief; and about axis $Z-Z'$ approach angle and plan relief. The main object of the equipment here described is to make possible such movements of turning and boring tools, and to provide accurate means for control and measurement of the movements.

Orientation of Faceted Diamond Tools

Faceted diamond tools are used extensively for turning and boring non-ferrous parts such as light-alloy pistons, brass bushings, babbitted bearings, etc. In many cases it is not only necessary to conform to a high standard of dimensional accuracy, but it is also essential to maintain a very fine surface finish. The surface finish produced in any particular turning or boring operation in which a faceted diamond tool is used is directly dependent upon the inclination of the principal cutting facet of the diamond tool relative to the axis of rotation of the work-piece; thus, in both turning and boring operations, it is desirable to have some means of precisely adjusting the orientation of the tool with respect to the work.

The importance of orientation of faceted diamond tools is well known in practice, but it is

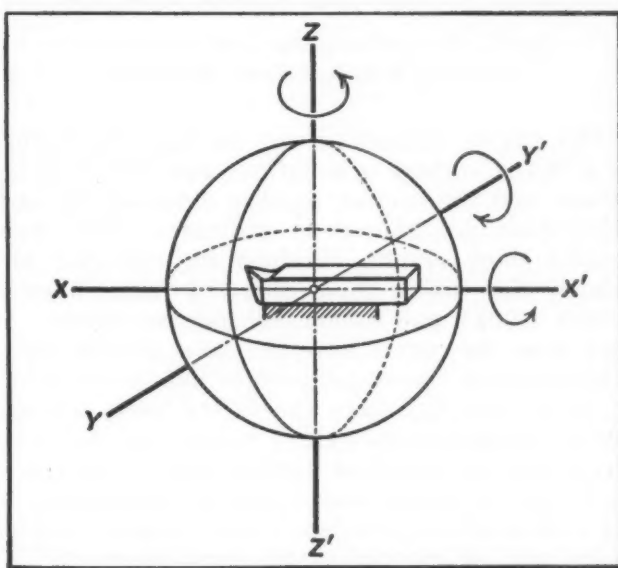


Fig. 1. Diagram Illustrating Adjustment of Tool about Three Mutually Perpendicular Axes

nevertheless instructive to observe the results of experiments that show the exact relationship between tool orientation and the surface finish produced. This relationship can be clearly seen in the graphs in Fig. 2, which represent the results obtained when turning with a faceted diamond tool which was rotated to various positions in the horizontal plane so that lengths of a specimen were turned with different orientations of the tool.

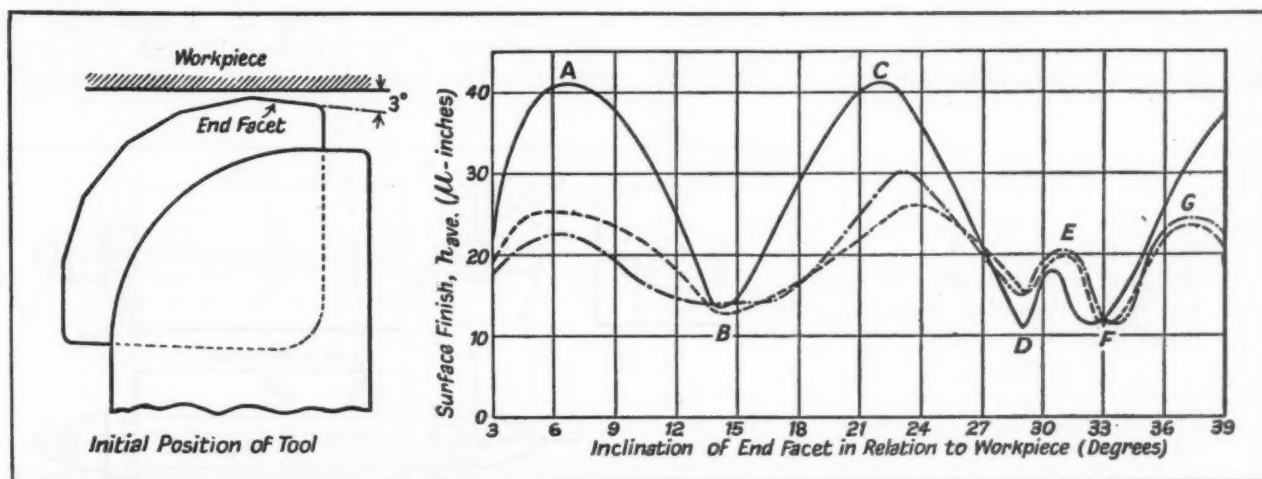


Fig. 2. Chart Showing Effect of Orientation of Faceted Diamond Tool on Surface Finish

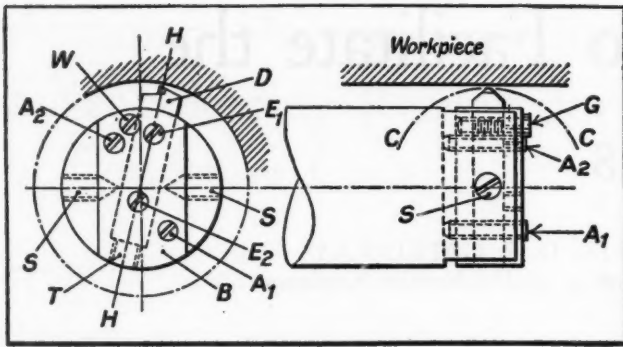


Fig. 3. Special Boring-bar with Provision for Adjusting Rake and Facet Orientation

The angles through which the tool was turned to give the various orientations are shown as abscissae and the surface finishes obtained for each orientation are shown as ordinates. The three graphs show results obtained on extruded aluminum alloy using three different feeds, namely, 0.0025, 0.0015, and 0.0005 inch per revolution. In each case, the curves have the same general form, indicating the smoothest surface finishes at points B, D, F, and G, where the facets were approximately parallel to the axis of rotation of the work-piece, and the roughest surface finishes at points A, C, and E, which correspond to orientations of the tool in which two facets were equally inclined to the axis of rotation of the work-piece.

From these results, it is clear that some accurate means of adjusting the orientation of faceted diamond tools with respect to the work being turned or bored is essential if these finishing tools are to be used in the most efficient manner.

In the case of turning operations with faceted diamond tools, it is usually possible to adjust the orientation of the facets with respect to the axis of the work-piece by swiveling the toolpost of the lathe. In well designed diamond turning lathes, the base of the toolpost is usually graduated, so that rotation of the tool can be carried out under controlled conditions and fine adjustments of orientation can be made to an accuracy amounting to within 1/2 or 1/4 degree.

In addition, some holders for diamond tips have swiveling heads so that the tool point can be adjusted for orientation while the main shank of the

tool remains stationary in the toolpost. In general, this method of adjustment is not so sensitive as that obtained by swiveling a graduated toolpost.

In the case of finish-boring with diamond tools, provision for adjustment of the orientation of the facets with respect to the work-piece must be made in the boring-bar. A special boring-bar, recently developed in the Research Department of the British Institution of Production Engineers for this purpose, is shown in Fig. 3.

The bar is slotted at its end, and in the slot a steel block B carrying the diamond tool D is pivoted on two screws S and adjusted about these pivots by the adjusting screws A₁ and A₂. By releasing A₁ and tightening A₂, or vice versa, the diamond tool can be caused to rotate about pivot screws S in the arc C-C, thus altering the orientation of the facets on the tool with respect to the axis of rotation of the work-piece. Adjustments of the diamond tool for changes in bore diameter can be made by devices incorporated in some patented diamond boring tools or by means of a fine screw shown at T in the swiveling steel block B. In either case, the diamond boring tool is locked in the block by the screws E₁ and E₂.

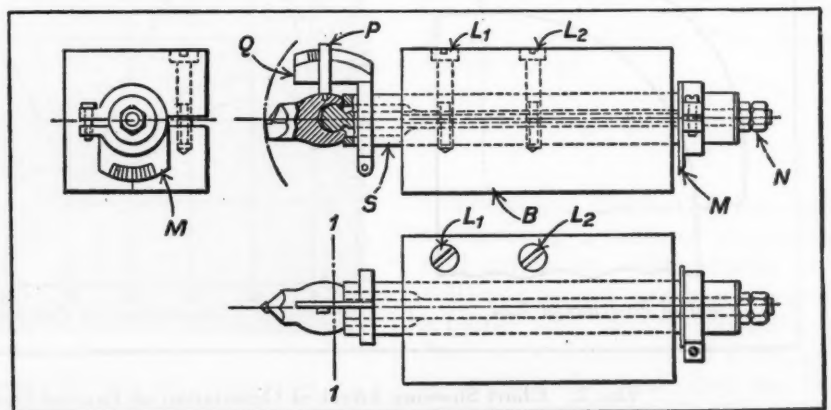
Adjustment of Rake

The device also includes a means of adjusting the rake. This is effected by the worm W, which meshes with teeth on the diamond-tool holder D and thus rotates the whole diamond boring tool about the axis H-H. Graduations on the head of the worm make it possible to control the degree of rotation of the diamond tool and therefore the change in rake. It is clear that any change in rake will be accompanied by an opposite change in clearance, since the wedge angle of the diamond remains constant.

Similar provision can be made in the case of diamond turning tools, but usually, as there is more space in this case, it is possible to incorporate larger and more accurate devices for controlling changes in side rake and back rake.

One type of special diamond-tool holder that permits easy and controlled adjustment of side and back rake is shown in Fig. 4. A ball-ended toolholder is held by its cylindrical shank S in a steel block B. The back rake is adjusted by loosening

Fig. 4. Diamond-tool Holder Designed to Provide Means for Easily Adjusting Side and Back Rake of Tool



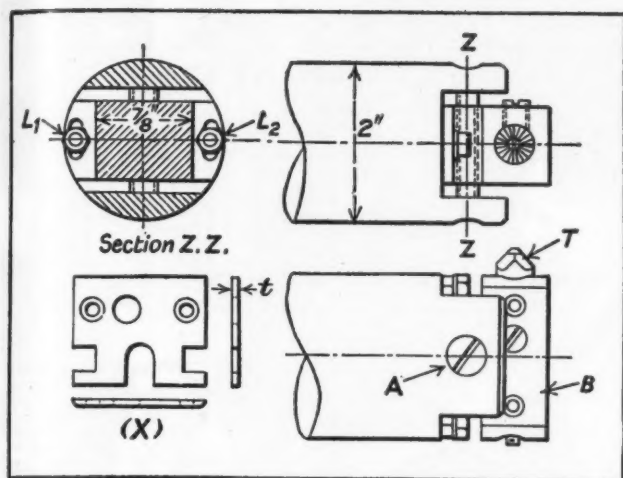


Fig. 5. Boring-bar Specially Designed to Permit Adjustment of Tool Height

the lock-nuts N and swiveling the point of the tool about its ball pivot so that the pointer P moves over the scale Q , from which it is possible to read accurately the changes in back rake. Adjustment of the side rake is effected by releasing the locking screws L_1 and L_2 , turning the shank S of the tool, and reading on a scale M the change in side rake. It will be observed that the introduction of scale Q and pointer P involves a sidewise restriction of ball-pivoted tools. This does not constitute a serious defect, however, because the sidewise movement can be effected in a much more accurately controlled manner by swiveling the whole of the tool-slide, as already described.

In the case of turning operations, the height of the diamond tool relative to the center of the work-piece can easily be adjusted in the normal way by the use of packing strips. With boring tools, the setting of the tool height relative to the center of the bored hole is not so easily effected. A special boring-bar recently made in the Research Department for investigations on fine boring with diamond tools set above and below center is shown in Fig. 5.

The boring tool T is held in a block B which is free to move in a wide slot cut in the end of the boring-bar. The block is moved by means of the adjusting screw A , and is locked in the required position by the screws L_1 and L_2 . Movement of the

block from its central position disturbs the balance of the boring-bar, and provision is made to restore this by fixing metal plates of varying thickness t , as shown at X , to either side of the block in such a way that the total mass of the block plus the plates is equally distributed on both sides of the center line of the bar.

The equipment described was originally developed for experimental purposes, but much of it can, with slight modification, be advantageously applied to commercial diamond turning and boring operations. Research and practice alike have shown that, given good machine design, particularly correct spindle-bearing design and the elimination of vibration, the ultimate fineness of surface finish attainable is largely dependent on the form and setting of the tool used.

* * *

Carbide Tool Resists Severe Impact on Maintenance Job

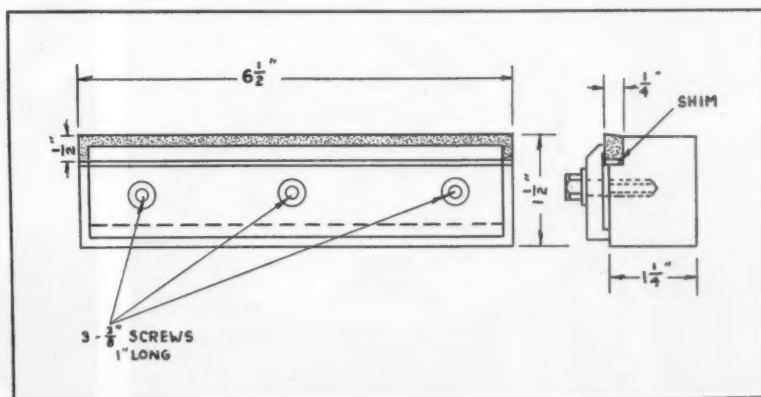
The reconditioning of hard chilled-iron rolling-mill rolls has been simplified and speeded up in one shop by the use of a Carboloy cemented-carbide tool on a plunge-cut turning operation. The chilled-iron rolls are approximately 20 1/2 inches in diameter by 53 inches long. The refacing tool was mounted on the bed of a roll-turning lathe in the conventional manner by the use of a yoke and wedge. The tip of the refacing tool was formed of cemented carbide.

The roll was turned at a speed of 15 surface feet per minute. The tool was fed into the work by means of a wedge, which was struck with a hammer. No tip breakage was experienced, and the tool life was found to be ten times longer than that of the conventional chilled tool which had formerly been used. As the carbide tip was reground, a shim was placed behind the tip, as shown in the accompanying illustration, so that the shank would not have to be reground.

* * *

And now the electronic juke box. It automatically plays louder when noises around it increase, and lowers its voice when the hubbub subsides.

Details of Carboloy Cemented-carbide Tool Used for Plunge-cut Turning in the Reconditioning of Rolling-mill Rolls



"This is Resistance Welding"— A New General Electric Motion Picture

A 16-MILLIMETER, all-color sound movie, called "This is Resistance Welding," designed to promote a broader understanding of the operating principles and the many advantages of the more widely used types of resistance welding, has been brought out by the General Electric Co. The film, which requires about thirty minutes to exhibit, can be obtained without charge from electric utilities, welder manufacturers, and General Electric offices throughout the country, for exhibition before engineering and manufacturing groups, schools, and other groups interested in resistance welding. The movie is part of General Electric's well-known "More Power to America" program.

Produced by the Raphael G. Wolff Studios, Hollywood, under the technical supervision of the General Electric welding laboratories, the film emphasizes the important part resistance welding is playing in the high-speed quantity production of innumerable products in a wide variety of sizes, shapes, and materials. Products ranging in size from the massive steel shell of a railroad coach to an electronic tube filament only 0.001 inch thick are shown being fabricated quickly, efficiently, and economically by resistance welding.

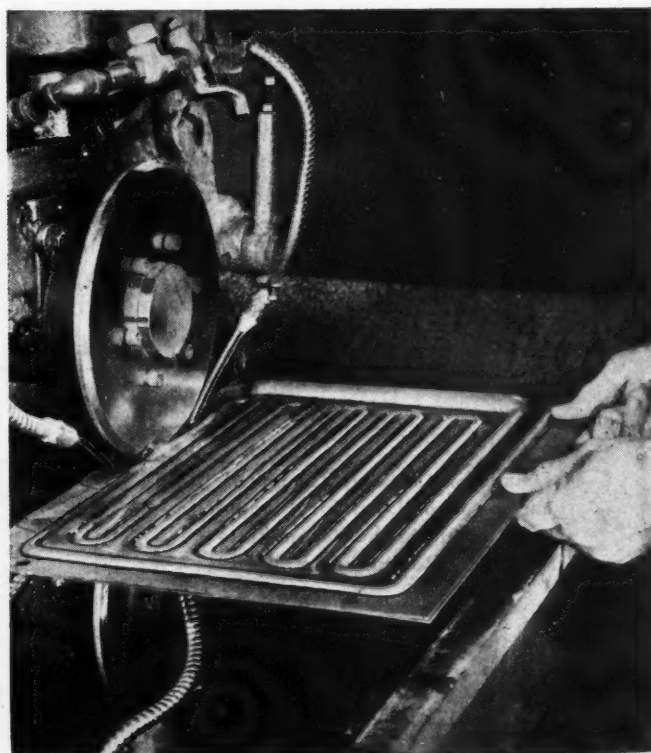
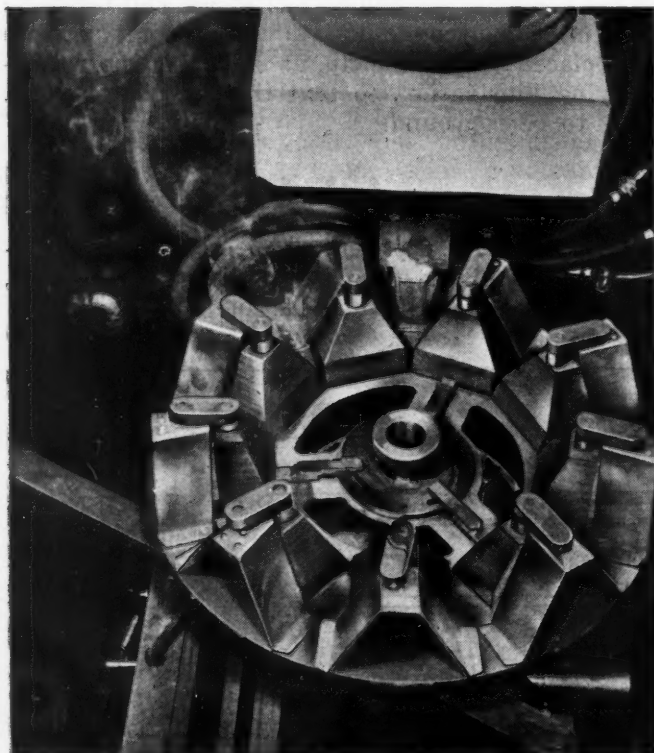
Following an introduction in which a striking parallel is drawn between modern resistance-welding technique and the primitive heat-and-pressure method of the village blacksmith, the movie opens



Fig. 1. (Above) Fans for Large Motors being Projection Welded at the Rate of Twenty-five Fans an Hour, as Shown in General Electric's Movie, "This is Resistance Welding"

Fig. 2. (Below Left) Close-up of the Projection Welding of Fans for Large Motors Shown in Fig. 1. This Method Offers a Convenient and Rapid Means of Joining Fan Parts

Fig. 3. (Below Right) A Refrigerator Evaporator being Fabricated by Seam Welding at a Rapid Rate



with a detailed explanation of the operating principles of resistance welding. Animated drawings and close-up views show how the pieces of metal to be welded are held under continuous pressure between the electrodes of the welding machine while carefully timed, low-voltage, high-amperage direct or alternating current fuses them together.

Next are shown the four principal types of resistance welding—spot, seam, projection, and flash welding. The operating principles, the distinct advantages, and the special capabilities of each of these important types are described in detail. Following this, the film shows how quantity production is made possible by modern resistance-welding machines, with their accurate pressure control, low inertia of moving parts, versatility, high speed, and low maintenance. The basic operation of synchronous electronic control equipment, which is used to bring new standards of precision in the regulation of welding current, is then described. The resistance of the work material to the current and the magnitude and the timing of the current are explained in a series of close-ups and animated diagrams.

The remainder of the movie is devoted to many typical examples of how electronically controlled resistance welding is cutting costs, increasing production, and opening new fields of employment.

* * *

Lincoln Foundation Announces \$200,000 Arc-Welding Award Program

An exceptional opportunity is offered to those engaged in the design, manufacture, or construction of any type of machinery or parts by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, through the announcement of its new \$200,000 "Design-for-Progress" Award Program. Prizes will be awarded for the best papers submitted on the application and use of arc-welding in industry. Three classifications of the program are devoted to machinery; these include functional machinery, industry machinery, and personal service machinery.

There will be eighty-four awards, totaling \$46,200, in the machinery design and manufacturing fields. The principal program award, which may be won by a paper in any of the machinery classifications, is \$13,200. Machinery maintenance work may also be entered in the competition. An author submitting a paper in any division of the machinery classifications that does not win any other award may still win one of the 217 honorable mention awards of \$100 each.

This award program is offered for the purpose of encouraging study and preparation of papers on design, research and education, application, and use of arc welding, and the results will be made available to industry generally. Complete details of the program, which closes June 1, 1947, can be obtained by writing the secretary, James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

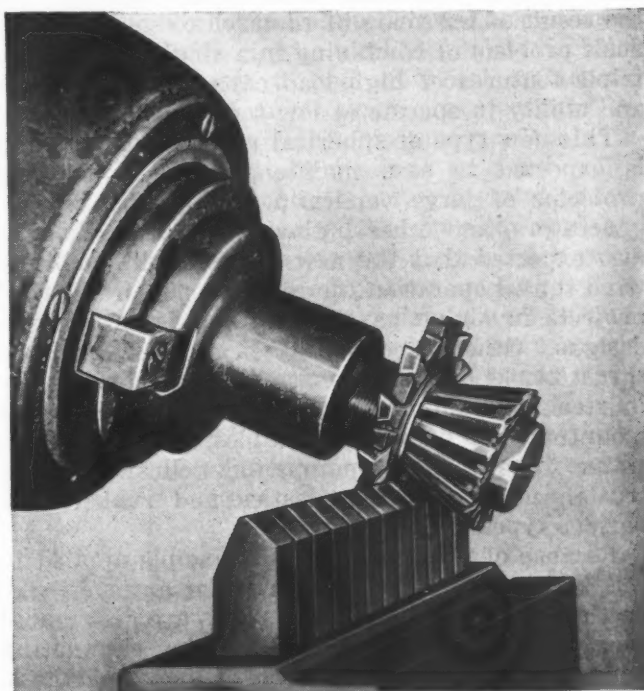
Multiple Milling of Tool Shanks Increases Production

By EARL WEAVER

Naval Ordnance Plant

Westinghouse Electric Corporation, Canton, Ohio

The old method of milling one tungsten-carbide tipped tool shank at a time was replaced at the Naval Ordnance Plant of the Westinghouse Electric Corporation, Canton, Ohio, by the method illustrated. This consists of using an inexpensive holding fixture that makes possible the complete multiple milling of similar shanks.



Equipment Used for Milling Two Faces on Several Tungsten-carbide Tipped Tool Shanks at One Time

The fixture holds the tools at an angle and in line, so that the two faces, or angular clearances, are milled simultaneously by two cutters mounted in the vertical head attachment of a horizontal milling machine. The clearance is established by an angular tilting plate in the base of the holding fixture. Production fluctuates with changes in the shank dimensions, but there is a definite increase over the old method.

* * *

Mechanical imperfections in fast moving machinery can now be detected while the machinery is operating, by the use of an X-ray machine which takes pictures at a millionth of a second speed, "stopping" the swiftest moving part. The X-ray pictures make it possible to look for wear or indications of the failure of parts while the equipment is operating at full speed.

Engineering News

New Spherical Roller Thrust Bearing Carries Heavy Loads at High Speeds

A new type of roller bearing, capable of carrying heavier loads at higher speeds and lower temperatures than has been possible up to the present time, is a development of the S K F Industries, Inc., Philadelphia, Pa. The new bearing, technically known as a "spherical roller thrust bearing," is the result of ten years of research to solve the difficult problem of combining in a single bearing the triple features of high load capacity, high speed, and ability to operate at low temperatures.

This new type of spherical roller thrust bearing is expected to ease maintenance and operating problems of large vertical water pumps, electric generators, and other high-speed machines. It is also expected that the new bearing will facilitate wind tunnel operation for research on aeronautical projects involving gas turbine and jet propulsion designs. Other important applications will include thrust blocks on marine propeller shafts, roll necks in steel and aluminum rolling mills, and thrust mountings for railroad turntables, water turbines, water wheels, dredge pumps, oil-well swivels, extrusion machinery for plastics and rubber, and various types of gear drives.

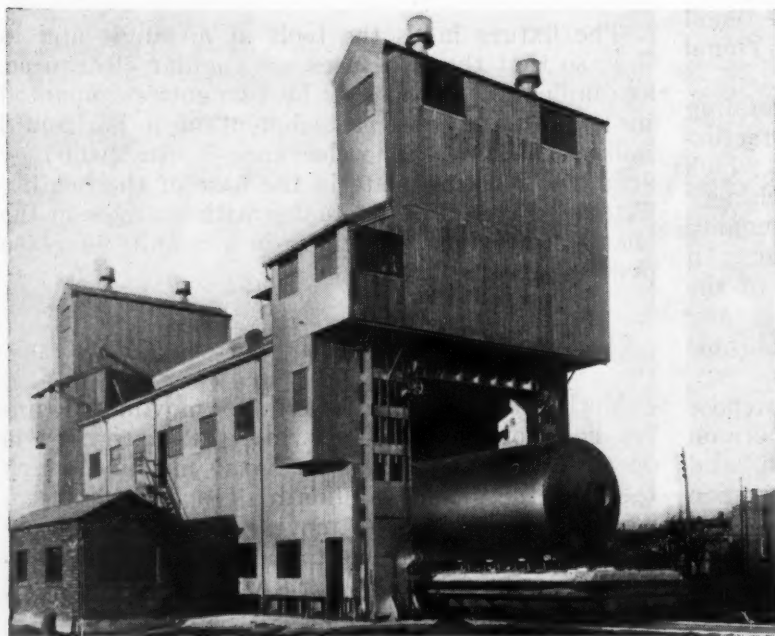
Because of the self-aligning principle applied in this bearing, which compensates for any shaft deflections or distortions, heavy loads are distributed evenly over all the rollers, thereby eliminating danger of overloading. Because of its compactness, the new bearing occupies less space and is lighter in weight than a plain bearing. The design also

permits more effective lubrication than was formerly possible in heavy-load, high-speed bearings. Another feature of the bearing is a cage retaining sleeve pressed into the bore of the inner ring, making a self-contained assembly of the rollers, cage, and inner ring.

Gas Turbine Gradually Approaching Practical Application Stage

On the assembly floor of the plant where the Westinghouse Electric Corporation assembles steam turbines, stands a machine 26 feet long, 3 1/2 feet wide, and 6 feet high. This equipment comprises a complete 2000-H.P. gas turbine with gearing and a connected direct-current generator. A Diesel generating set of the same horsepower occupies a space approximately 20 by 5 by 10 feet, or about twice the cubic volume. The Diesel equipment would weigh about 50,000 pounds, while the gas turbine and generator weigh 35,000 pounds. However, the gas turbine is not much more than half as efficient as the Diesel engine—about 18 to 20 per cent in the former case, as against 30 to 35 per cent in the latter case; but this is offset by the fact that the fuel for the gas turbine costs only about half as much per pound as the Diesel fuel. This experimental gas turbine is of the simplest form; that is, it has no intercoolers or heat-exchangers, and therefore can burn low-grade petroleum, such as bunker C.

The success of the gas turbine is closely tied to high-temperature operation. Steam plant equip-



The Largest of Three Stress-relieving Furnaces Constructed by the Rust Furnace Co., Pittsburgh, Pa., for the Chicago Bridge & Iron Co., Chicago, Ill., is Here Illustrated. This Furnace is 85 Feet Long by 15 Feet Wide and is 16 Feet High from the Car Floor to the Spring of the Arch. The Width of the Flat Car on which Work is Handled is 11 Feet

ment is generally limited to temperatures of about 1000 degrees F., while gas turbines present no difficulties up to 1300 degrees F. The 2000-H.P. experimental unit mentioned is designed for a maximum operating temperature of 1350 degrees F.

There is also in production another and quite different type of gas turbine at the Westinghouse plant. This is intended for jet-propelled aircraft. For this service, the life of the engine can be appreciably shorter, so that the heat at the turbine inlet is allowed to go as high as 1500 degrees F. At this temperature, the efficiency climbs well above 20 per cent. If metals are developed that can stand operating temperatures of 1800 degrees F., the efficiency of the simple open-cycle gas turbine will be close to 30 per cent.

Large Steam Turbines are Now Built in Standardized Sizes

The first standardized steam turbine built for local power generation is being produced at the South Philadelphia plant of the Westinghouse Electric Corporation. The unit is the result of a long recognized need for removing the custom-made label from such machines and introducing standard sizes applicable to given operating conditions.

The standardization idea was brought about by a committee organized by the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. Six sizes of turbines have been decided upon by the committee as within the range of the most common of the larger power plant sizes, and therefore the most suitable for standardization. These sizes run from 11,500 to 60,000 kilowatts in productive capacity. This range is sufficient to provide power for cities of from 10,000 to 50,000 population.

The standardization program will in no way hinder the building of any size of steam-turbine generator needed for purposes for which the standard sizes might not be suited; neither will it prevent building duplicates of machines already installed, for which patterns are available.

Automobile Body Parts Coated with Phosphate for Long Life

The durability of phosphate-coated Ford fenders, proved during the war years, has led to the extension of this type of coating to fenders, sheet-metal body parts, exposed nuts and bolts, and valve springs for the entire 1946 line of Ford and Mercury passenger cars.

The phosphate-coating process employed involves a combination etch and surface chemical change, since some iron is replaced by the formation of metal phosphate. While the resultant roughening is imperceptible to the touch, it serves as an excellent paint bond. Progressive rusting and paint lifting from an area subjected to accelerated salt-water spray testing was resisted for 500 hours on

a treated panel, as compared to only 75 hours on an untreated panel.

New phosphate-spray chambers accomplish a number of operations at the rate of a car a minute. These include degreasing, rinsing, phosphate coating, and a second rinsing, followed by a sealer treatment for increased corrosion resistance.

Carboloy-Tipped Tools Effectively Used in the Masonry Trade

A line of Carboloy-cemented carbide-tipped tools has recently been introduced by a Detroit organization for masonry work. These tools are reported to be giving excellent results. The development had its inception when Ralph Gwinn, a brick mason, asked his son Myron, who worked for the Carboloy Company in Detroit, to find out whether Carboloy tools would be of any value in overcoming the troubles that he had with his masonry tools, including the frequent sharpenings required.

A set of masonry tools, including a scutch to trim bricks, a brick hammer, a tile-setter hammer, and a 3-inch brick set used to cut glazed brick, were tipped with Carboloy and ground to shape. The brick hammer had Carboloy metal on both hammer head and cutting edge. The results were so surprising that, after having used these tools for a whole month without resharpener, the Gwinns decided to go into the business of manufacturing Carboloy tools for the masonry trade. It is reported that the new business is flourishing.

Steel Fireboats Propelled by Water Jets—a Wartime Development

Steel fireboats propelled by a water jet were a development of World War II. Built in 1942 by Hanley Engineering Service, the fireboats have a hull shape similar to a flat-bottom skiff, a square stern, a low deckhouse, and a small forward cockpit. The over-all length is 30 feet 6 inches, beam 10 feet 6 inches, and draft 2 feet 6 inches. They are driven by a four-cylinder Chrysler industrial engine that develops 28.35 H.P. The boats have a capacity of 10 1/4 tons, a maximum speed of seven miles per hour, and a cruising radius of fifty-six miles. These fireboats are equipped with four pumps, each having a capacity of 500 gallons per minute at 120 pounds pressure.

Electric Fan Shows Remarkable Endurance in "Life Test"

One model of a Westinghouse electric fan on "life test"—continuous operation in a 100-degree F. "hot room" without repair or overhauling—has lasted 29,000 hours and the test is still going on. The tip of the fan blade, in traveling through 2,436,000,000 revolutions, has covered enough distance to circle the world seventy-eight times.

Editorial Comment

There is a feeling on the part of some manufacturers that when the backlog of automobiles, refrigerators and other household appliances, farm machinery, railroad cars, etc., has been filled, our industries will come to a point where their activities will be greatly curtailed. They are of the opinion that the productive capacity of our industrial plants, even though it may be none

There are Unlimited Possibilities for Industrial Progress

too large to fill the present dammed up requirements, will be greater than necessary in years of normal purchasing needs. Perhaps those who hold this opinion forget the manufacturing potentialities of the great developments of recent years that have not yet been adequately explored.

Provided our Government does not continue on the road of encouraging inflation, there should be an era ahead of as great industrial activity as we have ever known, even after the present unfilled demand has been met. There is a great deal of potential purchasing power. In addition to the demand for manufactured consumer goods to be bought through current earnings, considerable purchasing power is tucked away in the form of war bonds that will come due gradually in the next ten years. All of these bonds will not be cashed in

New Inventions and Discoveries Require Further Expansion

advance; and unless money values are so inflated by Government policies that these bonds, when they become due, will have a greatly reduced purchasing power, these savings of a large group of our people will add greatly to the sustained demand for goods of all kinds for many years to come.

Furthermore, our industries will be able to continue to offer employment on a large scale in developing the many new fields of endeavor, the surfaces of which have barely been scratched. The manufacturers of scores of new devices and appliances, based on recent inventions and discoveries, will require considerable industrial expansion to meet the public demand for these new contrivances.

True enough, the pessimists say that there is little new on the industrial horizon to cause exceptional plant expansion—that present facilities are ample to meet the demand of all purchasers for the goods they will want, whether of new or old types. In the past, they say, there was extensive develop-

ment in railroad building, bridge building, and in the rapid development of our cities. Later came the bicycle era, the automobile, the radio, and the airplane. What is there now to correspond to these great developments?

Well, there is a good deal. Rural electrification alone, which is likely to cover vast new territories within the next decade, will open up entirely new fields for farm and home equipment—for electric motors and pumps, refrigerators, and electric household devices of all kinds. City-bred people are likely to forget that in the majority of homes

Industrial Warfare Only Can Halt Our Progress

throughout the entire country there is no modern plumbing, no refrigeration, no adequate up-to-date means of heating, no vacuum sweepers or electric irons, and surely no air-conditioning. Here are virgin fields for industrial activities.

Then, to mention just a few other fields, there is television, Diesel-electric equipment and modernized passenger cars for our railroads, more efficient equipment for our power stations, and modernized factory machinery throughout industry. These are only a few examples; the list could be extended almost without end. Consider the vistas opened up to the imagination by the use of atomic power for peaceful purposes. It seems that our industrial prospects depend chiefly upon whether, as a nation, we shall have the good sense to make full use of our opportunities, and not dissipate our heritage in industrial and class warfare.

▼ ▼

The standard of living in peace, as well as security in war, rests primarily upon the facility with which machine tools can be built, because the machine tool must produce all equipment for both

Why Does Government Hamper an Industry Vital to Prosperity?

peace and war. This nation learned during the early years of the war that it was impossible to arm rapidly without an adequate supply of machine tools. But no sooner had the emergency passed than this lesson was forgotten; and, instead of encouraging, Government agencies have done much to discourage the individual enterprise that built the machine tool industry of the past and that must build it in the future.

A User Enumerates Future Requirements for Machine Tools

AT the Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corporation, Pittsburgh, Pa., in April, J. R. Weaver, manager of the East Springfield Works of the corporation, spoke on the requirements for machine tools in the future. He emphasized that industry should give more attention to cutting tools, jigs, and fixtures, as well as to the machines themselves.

Often this phase of the problem is left to the user, and in many cases he is not so well versed in the design of tools and fixtures as the machine tool manufacturer. Some machine tool builders tool up production machines completely. This, however, applies more specifically to mass production. The assistance of the machine tool builder is also needed in manufacturing plants where operations are not really on a mass production scale.

Ten points were outlined by Mr. Weaver relating to future requirements in machine tool design:

1. *Size of Machines*—Space is becoming more and more an important factor in production plants. We are building larger and larger factories, but it is economical to hold space to a minimum. Therefore machine tools should be designed to be as compact as possible.

2. *Ease of Operation of Machines*—Machines are desired that require the least amount of skill in the operator. This is true all the way from a simple drill press to a complicated automatic machine. Need for simpler operation is brought about by labor's drive to increase the wages of the lower paid operators in greater proportion than the wages of the skilled mechanics. Because of this, the inducement to learn a trade is becoming less and less. Therefore the machine tool must supply the skill formerly possessed by the man.

3. *Maintenance of the Machine*—For the same reason, maintenance of a machine tool must be kept to a minimum. It should be possible to make repairs in the simplest way. Whenever possible, the machines should be so designed that worn parts can be easily replaced, instead of requiring actual repairs to be performed.

4. *Electrical Developments*—Electricity will continue to play a very important part in the operation of machine tools. The developments along this line require motor or control applications to reduce hand operations even further.

5. *More Accurate Machines*—Better, faster, and more accurate means of inspecting and measuring work are being developed. While the record of accuracy accomplishments in the machine tool field is remarkable, efforts for obtaining still further accuracy must not be relaxed. Greater accuracy in the machined parts results in faster assembly

and a better product, as well as in increased overall economy.

6. *Construction of Machines*—It is probable that closer tolerances will require increased attention to a stiffer and more rigid construction. More sturdy construction will also be necessary to withstand the greater forces needed for faster removal of metal called for by new types of cutting tools and higher speeds.

7. *Control of Thermal Expansion*—It may be necessary to consider the use of construction materials similar to "Invar," which have an almost zero coefficient of temperature expansion. This would eliminate inaccuracies in operation due to heating parts of the machine. Such a feature would increase the available productive hours of a machine tool by eliminating the warming up time and the necessity for resetting tools near the start of the run. It would also reduce scrap losses and permit efficient operation with less skilled workmen.

8. *Reducing the Set-Up Time*—Another desirable objective in machine tool design is to develop features for presetting cutting tools to give finished tolerances without too much "cut-and-try" and to provide means for gaging and measuring the machined surfaces right at the machine, so that when the operation is completed, it will be correct.

9. *More Special-Purpose Tools*—Possibly there should be a still further development of special-purpose tools in place of multi-purpose tools. This would eliminate adjustments and adaptations. In the past, machine tools have been capable of accommodating a large range of sizes of work and have had built into them facilities and features for performing a great many operations. Rarely does a manufacturer of mass production items make use of more than a few of these facilities.

10. *The Ideal Machine of the Future*—It is possible that in the future we shall aim toward eventually performing all the operations on a piece of work in one machine. A machine to do this will combine many dissimilar operations, yet it may be made sufficiently flexible to take care of periodic changes in the design of the product. When it is necessary to change the method of holding a piece for the completion of an operation, positive automatic transfer means must be devised.

For example, a certain part, of which 30,000,000 were made for war purposes, required five different machines for punching, drawing, trimming, embossing, and piercing. Obviously the part had to be conveyed from one machine to another between all of these operations. A machine designed so that all these operations could be performed in one unit would have saved floor space, transportation, operators, and man-hours.

Working Conditions in a Machine Shop Improved by Sound-Conditioning

By FRANCIS A. WESTBROOK

SOUND-CONDITIONING in machine shops has been greatly stimulated by recent experiences in war production plants, where it was found that noise-reducing installations were of practical value in increasing output by reducing nervous fatigue in workers susceptible to noise distractions. In the vanguard of concerns to adopt this step toward ideal working conditions was Austenal Laboratories, Inc., New York City.

A noise condition somewhat out of the ordinary arose at the Austenal Laboratories in a manufacturing space equipped with over one hundred small grinders having wheels ranging from $\frac{3}{8}$ to $\frac{7}{8}$ inch in diameter. These grinders are driven by direct-connected motors at speeds of from 20,000 to 35,000 R.P.M. At speeds of 25,000 R.P.M. and up, a high-frequency noise developed which was very annoying to the workers—many of them women, who are more susceptible to noise than men.

This machine shop area was given an acoustical treatment consisting of cementing Acousti-Celotex C-6 tile to the ceiling. The accompanying illustration shows this tile ceiling clearly. The work was done at a time that did not interfere with production. The effect of the new ceiling was to reduce the higher range of noise, and although the lower tones were still present, the room was considerably quieter.

In addition, the entire ceiling of the office area, involving some 5000 square feet, was given acoustical treatment. In the portion occupied by the accounting division, where the majority of the adding and calculating machines are located, the south and west walls were also given the acoustical treatment from ceiling to floor. The purpose of this was to cut down the reflection of noise from the glazed-tile side walls. A major portion of the objectionable noise was thus eliminated.



Objectionable Noise in This Machine Shop, Caused by a Large Number of High-speed Grinders, was Reduced by Installing Tile Ceilings

Wheelock, Lovejoy & Co. Celebrate Hundredth Anniversary

One morning in 1846, so we are told, a young man clambered up a ladder against the side of a building at 51 Kilby St., Boston, Mass., to hang a brass sign announcing that Lewis Bullard & Co., dealers in metals of all kinds, were open for business. This was the beginning of the organization that is now known as Wheelock, Lovejoy & Co., Inc.

The firm of Lewis Bullard & Co. flourished and developed along with the rapid industrial progress of the country. It changed its name a number of times, but the organization as a whole remained the same. In 1859, it became known as Bullard, Abbott & Co.; in 1865, as Abbott & Howard. In 1868, a New York office was established, and in the same year a contract was made with Thomas Firth & Sons, steel makers, of Sheffield, England, by means of which Abbott & Howard became sole agents for the English concern. This relationship continued until the beginning of the first World War, and terminated then only because no imports of tungsten steel were permitted.

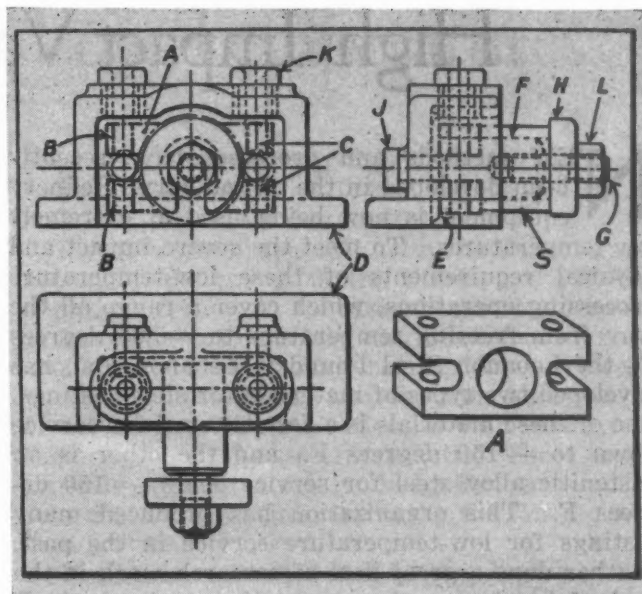
In 1869, a Chicago office was opened, and in 1873, the firm became the exclusive agents of Thos. Goldsworthy & Son of England, for the sale of emery. In the seventies, the organization twice changed its name, first to Jere: Abbott, and later to Jere: Abbott & Co. In the eighties and early nineties, the company imported Scotch pig iron, Krupp's Spiegeleisen, German soft steel wire rods, and Swedish iron and steel, and also dealt in domestic Bessemer iron and copper.

In 1893, the firm name was again changed, this time to Abbott, Wheelock & Co., and in 1897, to Wheelock, Abbott & Co. The same year the organization became agents for the entire United States for crucible tool steel manufactured or sold by the Firth-Sterling Steel Co. of McKeesport, Pa. Finally, in 1898, the name of the organization became Wheelock, Lovejoy & Co., which continued until 1918, when the firm was incorporated under its present name of Wheelock, Lovejoy & Co., Inc.

Throughout its history this organization has been one of the leaders in its field, holding an outstanding position in industry as distributor of alloy steels and of the trademarked Hy-Ten special steels. The company has issued an attractive historical publication entitled "100 Years of Continuous Service to Industry" commemorating its anniversary.

* * *

In Europe today, victory means nothing. We of the United States of America should be happy and proud—our men have homes and jobs to come home to. Our problems are small compared to the enormous poverty and degradation that faces Europe. The drive for success is dead. The only lesson we can take is that we, in this country, should all work together to keep and further develop advances for the good of the people of the entire world.—*R. D. Wasserman, President, Eutectic Welding Alloys Co.*



Jig Designed for Drilling the Slotted Ends of a Swivel Bracket

Drill Jig for Swivel Bracket

The swivel bracket shown at A in the lower right-hand corner of the accompanying illustration is required to have holes drilled and reamed through the fork-shaped ends. Previous to the drilling and reaming operations, the swivel bracket is bored and faced and the fork ends are milled. After the work A is clamped in the jig in the position shown by the dot-and-dash lines in the upper left-hand corner of the illustration, the holes at B and C are drilled and reamed to receive the joint pins. It is essential that the reamed holes be at right angles to the milled slots.

The jig consists of a cast-iron body D with a machined base and a vertical face E for locating the piece in the correct position under the drill bushings. The arbor F centralizes the work A, and the stud G and U-shaped washer H are used to clamp it in place. The two pins J with machined heads are located in the same horizontal plane as arbor F. The smaller ends of these pins are made to fit the milled slots in the work, and thus provide a simple means of locating the work radially. The ends of the two pins J are made short enough to clear both the drill and the reamer.

The two slip bushings K in the top plate are casehardened and ground. The work A can be loaded into the jig or removed by simply loosening the nut L and removing washer H and collar S, the bore in the work being large enough to pass over nut L.

* * *

We don't want inflation. We want the lowest prices that industry and business can offer. But laws can't keep prices down. The only thing in the world that can keep prices down is competition. Take off the price ceilings and give competition a chance.—*George T. Trundle, Jr.*

High Impact Values of Steel Castings

NEW methods and processes have recently been developed in the oil industry. Refinery equipment is now being used at extremely low temperatures. To meet the severe impact and physical requirements of these low-temperature processing operations, which cover a range all the way from freezing temperature to -300 degrees F., the Lebanon Steel Foundry, Lebanon, Pa., has developed two types of materials for steel castings. One of these materials is a ferritic steel for service down to -150 degrees F., and the other is an austenitic alloy steel for service below -150 degrees F. This organization has produced many castings for low-temperature service in the past, and has done a great deal of research work in the field of low-temperature operations. As a result of this research and experience, charts have been prepared showing the impact characteristics of the castings produced for sub-zero service.

Referring first to the ferritic type of steel cast-

ing material, Charts Nos. 1 and 2 have been prepared. Chart No. 1 covers what is known as "Circle L 19" steel. The curves illustrate impact values for the normalized and tempered and the quenched and tempered conditions, respectively. These impact values should be of great interest to designing engineers.

The analysis of this steel is as follows: Carbon 0.15 per cent; silicon 0.40 per cent; manganese 0.70 per cent; nickel 3 per cent; and the remainder iron. The physical properties are of interest, as well as the impact values. In the normalized and tempered condition, this steel has a tensile strength of 78,000 pounds per square inch; a yield point of 48,000 pounds per square inch; an elongation of 26 per cent; and a reduction of area of 48 per cent. The Brinell hardness averages 170.

In the quenched and tempered condition, the tensile strength is 85,000 pounds per square inch; the yield point, 60,000 pounds per square inch; the elongation, 23.5 per cent; and the reduction of area, 50 per cent. The Brinell hardness averages 190.

Chart No. 2 shows the impact values obtained with a triple alloy type of steel having unusual impact, as well as physical, properties. This steel is known as "Circle L 205," and has the following composition: Carbon 0.30 per cent; manganese 0.80 per cent; silicon 0.40 per cent; chromium 0.60 per cent; nickel 0.60 per cent; molybdenum 0.20 per cent; and the remainder iron. In the normalized and tempered condition, this steel has a tensile strength of 100,000 pounds per square inch; a yield point of 70,000 pounds per square inch; an elongation of 20 per cent; and a reduction of area of 45 per cent. The Brinell hardness averages 190.

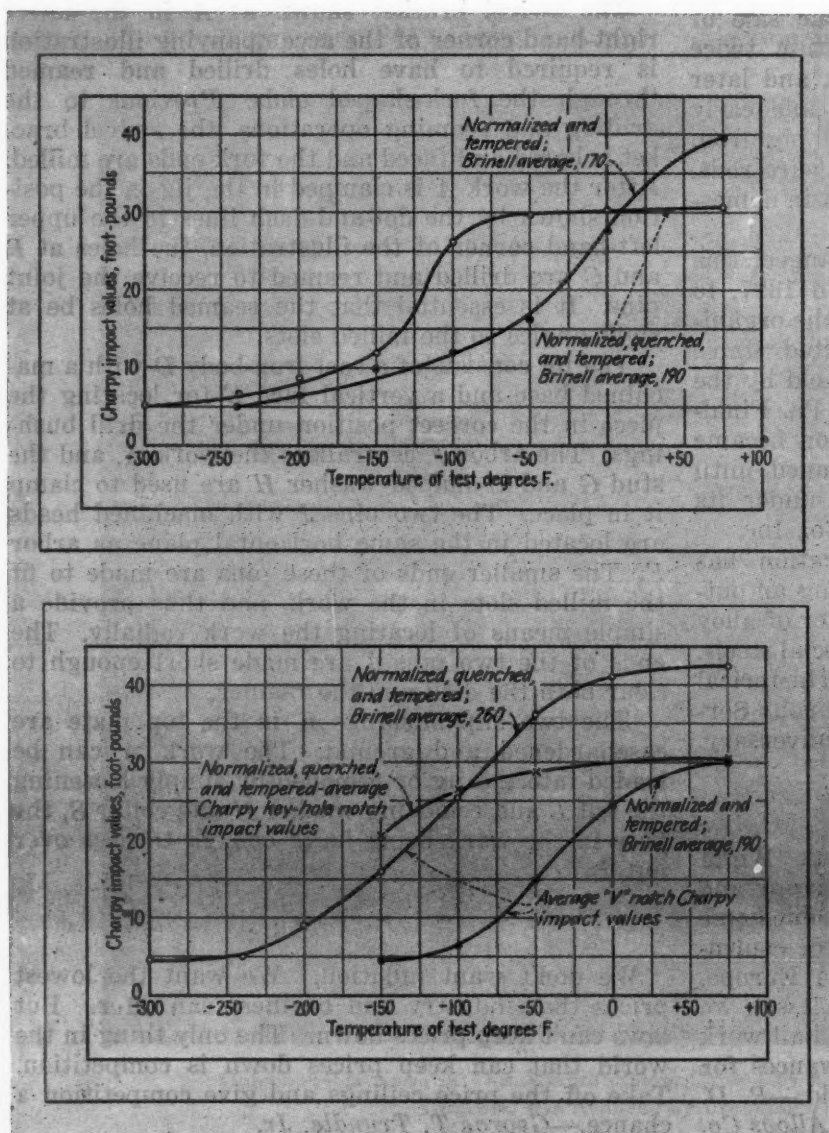


Chart No. 1. (Above Left)
Curves Showing Impact Characteristics of "Circle L 19" Steel. The Specimens were Prepared from 1 1/8-inch Square Stock

Chart No. 2. (Below Left)
Curves Showing Impact Characteristics of "Circle L 205" Steel. The Specimens were Prepared from 1 1/8-inch Square Stock

for Use at Extremely Low Temperatures

In the quenched and tempered condition, the tensile strength is 127,000 pounds per square inch; the yield point, 114,000 pounds per square inch; the elongation 17 per cent; and the reduction of area 45 per cent. The Brinell hardness averages 260. Attention is especially directed to the effectiveness of the quenching and tempering operation on this triple alloy steel, as indicated by its impact values at -150 degrees F., and as compared with the "Circle L 19" steel.

Chart No. 3 shows impact values of the austenitic type of steel for use at temperatures of -150 degrees F. and below. This steel is known as "Circle L 22." It has proved its value over many years of service in low-temperature work. It has an analysis of: Carbon 0.07 per cent; manganese 0.75 per cent; silicon 1.25 per cent; chromium 19 per cent; nickel 9 per cent; and the remainder iron. Its impact values at low temperatures should be noted. At average room temperature, this steel

has a tensile strength of 72,000 pounds per square inch; a yield point of 33,000 pounds per square inch; and an elongation of 60 per cent.

The data given, together with the impact values shown by the curves in the charts, provide engineering information for these types of steel when processed under carefully controlled conditions. It should be borne in mind that variables in design, variations in sections, and the complexity of the structure under consideration have an influence on the behavior of the steels in practice. These factors must be kept in mind in designing parts and in selecting the materials, especially for low-temperature service.

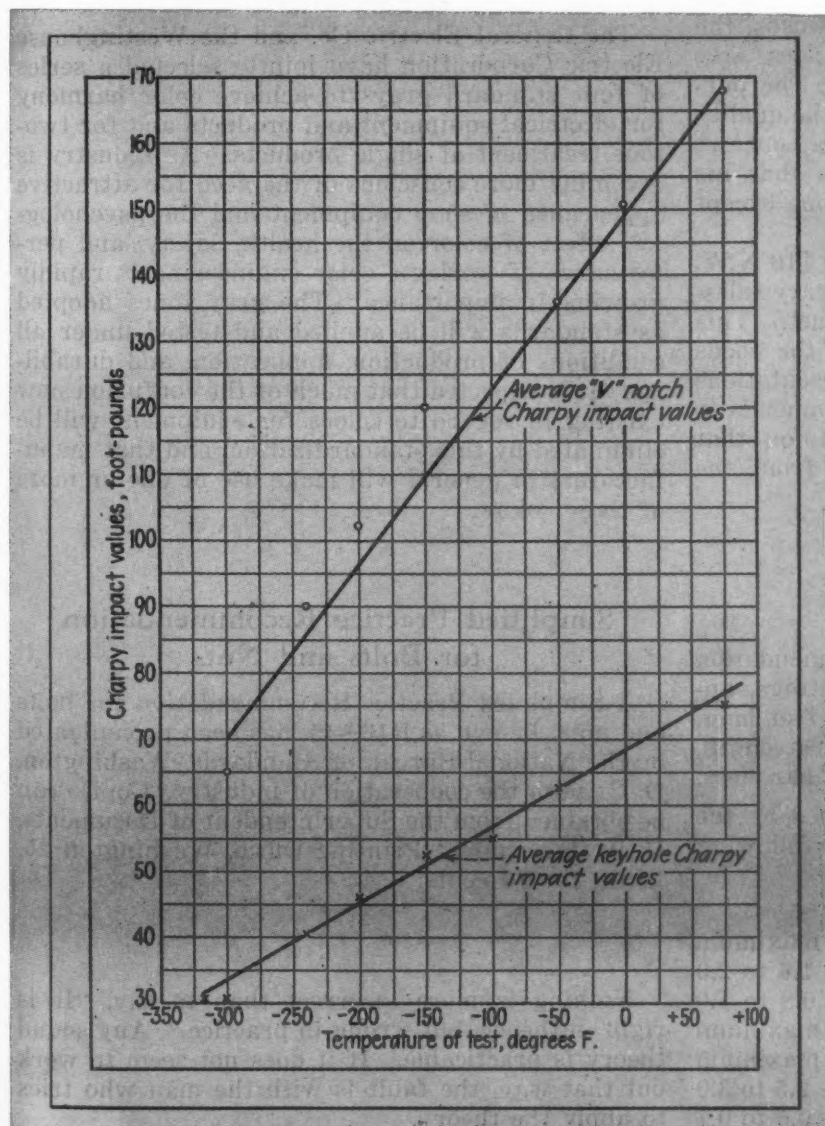
The Lebanon Steel Foundry is now preparing to make tests of materials for service at temperatures as low as -308 degrees F., and is constantly making tests on additional materials. This research has proved of great importance in the development of low-temperature oil-refinery equipment.

* * *

Logan "Air-Draulic" Cylinders

In the description in the May number of MACHINERY of a line of "Air-Draulic" cylinders developed by the Logansport Machine Co., Inc., 910 Center Ave., Logansport, Ind., it was stated that the cylinders were built with separate air and hydraulically operated pistons that are assembled as an integral unit on a common piston-rod. This statement was incorrect in that the cylinders are not operated hydraulically. They are operated by air, and have a hydraulic type precision control. No pressure is applied to the hydraulic piston and no separate hydraulic power unit is required.

Chart No. 3. Specimens of "Circle L 22" Steel Subjected to Charpy V-notch and Keyhole Charpy Impact Tests. The Specimens were Prepared from 1 1/8-inch Square Stock. Heat-treatment, 2050 Degrees F., Water Quench



Questions and Answers

Validity of Exaggerated Sales Statements

P. F.—Recently we bought some equipment. The manufacturer's salesman told us that the equipment he sold us was the "very best" on the market. Later we found that this was not true. In fact, we believe that other equipment built by other manufacturers is better in quality, and we would have bought the other equipment had the salesman not convinced us that his statement was true. Can we recover if we bring suit against the seller?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

Recent higher court decisions are to the effect that a sales contract *cannot* be rescinded or cancelled on the contention that a seller, or his salesman, "highly" praised his product. In other words, the courts recognize the fact that all sellers may "highly" recommend their own product. The purchaser must decide for himself whether the quality of the goods satisfies him. If he makes a contract to purchase and subsequently discovers that his judgment is erroneous, he can hold no one except himself responsible.

In a recently decided higher court case [10 N.W. (2d) 452], the Court recognized the ordinary salesman's "puffing" of his employer's product. This higher court said: "Puffing, or praise of the goods by the seller, is no warranty, such representations falling within the maxim 'simplex commendatio non obligat'." Therefore it is my opinion that you cannot sue and recover damages from the seller.

High-Strength Castings

O. D.—I would like to obtain a recommendation for the composition of cast iron for castings, approximately 10 inches in diameter by 4 feet long, which are required to have unusually high strength, high elastic modulus, and great surface hardness.

A.—"Nickel Cast Iron News," published by the International Nickel Co., suggests the following approximate composition:

	Per Cent
Carbon	2.8, maximum
Silicon	1.6 to 2.0
Manganese	0.8 to 1.0
Phosphorus	0.2, maximum
Sulphur	0.12, maximum
Nickel	2.5 to 3.0
Molybdenum	0.5 to 0.7

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

This iron will have a tensile strength, in a 2-inch diameter test bar, of approximately 60,000 pounds per square inch. The design, however, should be based on a tensile strength of 55,000 pounds per square inch and 21,000,000 pounds modulus of elasticity. The design strength should be taken lower

than the actual test bar strength because of the difference in thickness between the test bar and the actual casting. These castings will have a hardness of between 250 and 300 Brinell, so that they can be machined. If necessary, the surface can be hardened by flame-hardening.

* * *

Standard Grays for Engineering Equipment

The General Electric Co. and the Westinghouse Electric Corporation have jointly selected a series of four standard grays to achieve color harmony for electrical equipment and products and for two-tone treatment of single products. As industry is becoming more conscious of the need for attractive appearance in shop equipment and the psychological effect of color on the health, safety, and performance of workers, color engineering is rapidly growing in importance. The gray tones adopted as standards will be applied and tested under all conditions of production, application, and durability. It is expected that much of the confusion now existing in regard to colors for equipment will be eliminated by this standardization, and that manufacturers in general will make use of one or more of these colors.

* * *

Simplified Practice Recommendation for Bolts and Nuts

A Simplified Practice Recommendation for bolts and nuts, known as R169-45, has been promulgated by the National Bureau of Standards, Washington, D. C., with the cooperation of industry. Copies can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 10 cents.

* * *

Nothing is more incorrect than to say, "It is right in theory, but wrong in practice." Any sound theory is practicable. If it does not seem to work out that way, the fault is with the man who tries to apply the theory.

Ingenious

MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Automatic Hopper Feeds for Small Cylindrical Parts

By E. W. DUSTON

Rings or cylindrical parts can be automatically fed from a hopper by means of the mechanism here illustrated. The hopper shown in Fig. 1 is used to feed cylindrical pieces 1 1/4 inches in diameter by 1 inch high at the rate of forty per minute. This hopper consists essentially of a base *A*; a bowl *B*, in which the parts are placed; and a vertical reciprocating slide *C*. Slide *C* has two steel strips *D* attached to its sides. The strip nearest the base of the hopper is made higher than the one adjacent to the bowl. The slide has a vertical reciprocating movement of five strokes per minute. At the bottom of the stroke which aligns the slide with the

bottom of the bowl, the work-pieces fall into the groove formed by strips *D* on slide *C*.

Slide *C* may be reciprocated vertically by means of a crank and slotted cross-head, or a Scotch yoke type of mechanism, which will permit the slide to dwell slightly at the lower and upper positions of its stroke, thus allowing the parts to fall into or roll out of the slide. When the slide reaches the upper end of the stroke, the pieces roll into the covered chute *E*, down the tube *F*, and into elbow *G*. The elbow changes the path of the pieces 90 degrees, and delivers each piece resting on a flat face. The weight of the parts following keeps the leading part against a stop. This part is fed by means of a pusher mechanism similar to the one shown in Fig. 2.

The hopper shown in Fig. 2, which is used for feeding brass rings, is similar to the one just de-

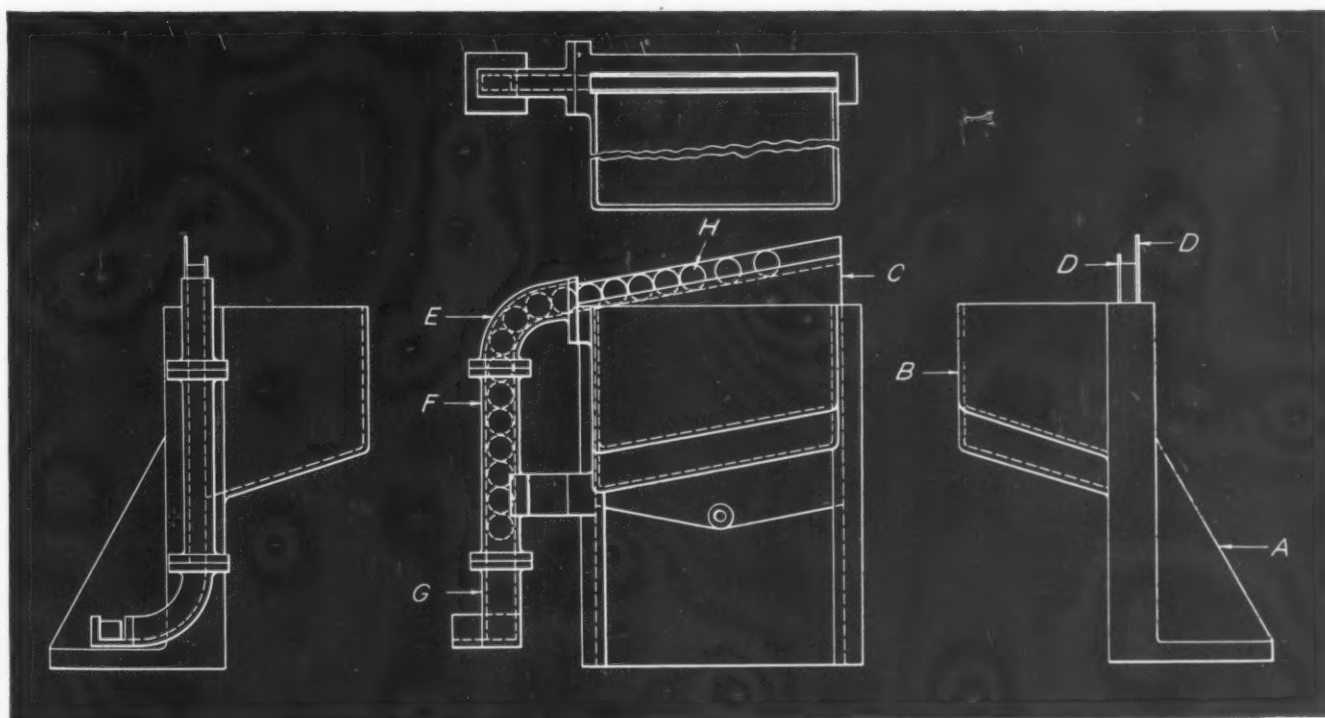


Fig. 1. Hopper Feed with Reciprocating Slide *C* Arranged for Handling Cylindrical Parts

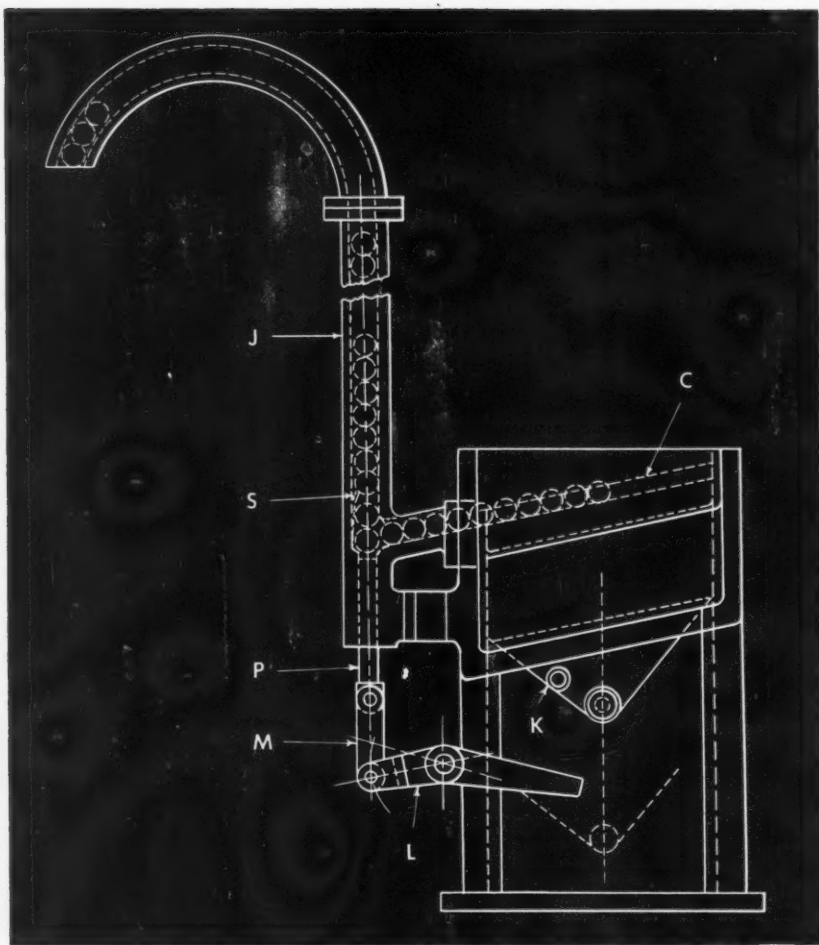


Fig. 2. Arrangement Designed for Feeding Rings Vertically from a Hopper

scribed. However, the work-pieces are fed vertically instead of horizontally. Details of the feeding mechanism are shown in the illustration. When slide *C* reaches the upper end of the stroke, the parts roll into the vertical covered chute *J*. As the slide moves down, roll *K* comes in contact with lever *L*. This action causes link *M* to move plunger *P* up, pushing one or more parts above the spring *S*. The spring supports the column of rings, which is advanced by each stroke of the slide.

* * *

Strikes Against National Welfare are, in Effect, Civil War

In 1919, the late President Coolidge, then Governor of Massachusetts, said, in effect, that no group has the right to go on strike against the public welfare or safety, anywhere, at any time. This elementary fact ought to be clear to anybody who lives in what is supposed to be a civilized community; but although it is twenty-seven years ago since the late President Coolidge gave expression to this idea, our Administration and Congress have not yet recognized the importance of this statement. We permit individual citizens to exercise powers greater than those of the President and the Government of the United States.

Electric Motors of Light Weight per Horsepower

It is significant that we find a continual flow of new ideas and improvements in an old-established field of engineering such as that of the electric motor. One might assume that by now most everything that could be known about electric motors is known and that relatively few major improvements would be possible. However, progress in motor design is as marked as in many other fields. A special direct-current motor weighing only 8 1/2 pounds, but developing 22 H.P., was produced by the Westinghouse Electric Corporation to accelerate the gyroscope of an electric torpedo. This motor is able to bring the gyroscope motor from standstill to 12,000 R.P.M. in one-fifth of a second.

Another direct-current motor, weighing 31 pounds and developing 18 H.P., is used to bring the rotor of a gas turbine from a standstill to 2000 R.P.M. in fifteen seconds. Special small induction motor armatures have been built that are able to withstand a temperature of 500 degrees F. in a high vacuum without the formation of gas by any of the insulating materials. Another recent improvement is in the speed range of direct-

current motors. The speed range of these motors has commonly been assumed to be limited to about 4 to 1 by field control. Recently that speed range has been extended to 8 to 1 by the relatively simple method of reconnecting and providing a separate control of magnetic poles.

* * *

Reversing the wartime trend, Henry A. Wallace, Secretary of Commerce, proposes to return to private enterprise the important function of determining industrial and consumer standards. In a letter to Charles E. Wilson, president of the General Electric Co. and chairman of the Policy Committee on Standards appointed by the Secretary of Commerce in January, 1945, Mr. Wallace characterized the negotiation and publication of standards through private initiative and on a wholly voluntary basis as "eminently desirable."

* * *

The jet engine, which made possible speeds in excess of 600 miles an hour on the Lockheed Shooting Star's recent record-breaking transcontinental flight, has 500 welded joints. Virtually every known type of welding was used in this application.

Tool Engineering IDEAS

Methods of Locating and Boring Shaft Holes in Gear-Boxes

Devising methods for locating and boring shaft holes in gear-boxes often taxes the ingenuity of production engineers and tool designers. First the distance between the shaft centers must be determined. In some instances, the theoretically correct center distance between the shafts of mating gears must be modified to compensate for changes caused by heating of the crankcase in operation.

On large-quantity production work, the method is to experiment with several gear-boxes having gears running at various center distances and to adopt as standard the dimensions which give the best results. The test-bar methods usually employed for limited production and for boring the shaft holes for large gears is illustrated in Fig. 1. The procedure is first to bore one of the holes and insert

a test-bar shaft *A* of known diameter in it. Then a test bar *B* is placed in the boring head and, using a square, a height gage, Johansson blocks, or an internal micrometer, the dimensions *X*, *Y*, and *Z* are arrived at by adjusting the work-table and boring head. Next, the test bar *B* is replaced by the boring-bar and the second hole is bored in accurate location.

This method can be adapted for a variety of set-ups. It is useful where machines are old and production is not large enough to justify special boring fixtures. In such cases, the essential equipment consists of slotted angle brackets *B* (Fig. 3) and the bushing arms *A*. In Fig. 3, one line of holes has already been bored at *a* by the use of two angle brackets and a pair of bushing arms, one arm being bolted to each angle bracket. The boring-bar is passed through the cored holes and piloted by the bushings in the arms *A*.

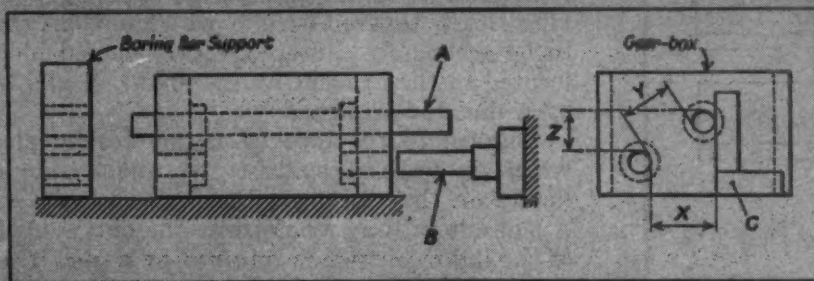


Fig. 1. (Above) Diagrams illustrating method of using test bars to assure accuracy in drilling shaft holes in gear box

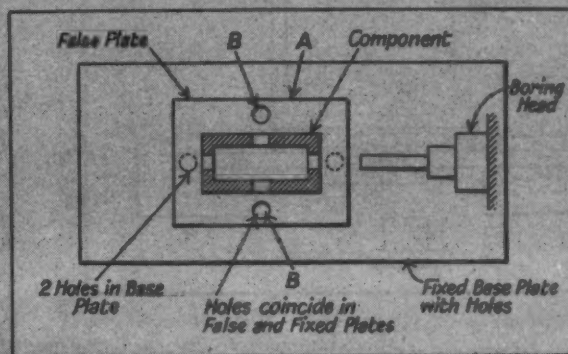


Fig. 2. (Right) False Plate Set-up Used in Gear-box Drilling Operations where Axes of Shaft Holes are in One Plane

The next step is to mesh the service gears, or the gears to be used in the box, by mounting them on arbors supported by the bushing arms. The gears are blued and tested for backlash. The distance to be allowed between the centers is then determined, and the bushing arms and brackets are secured. The boring-bar is now passed through the box and the boring operation continued. It will be seen that this method provides for locating the work so that a series of gear-boxes can be bored without the use of special fixtures.

Among other methods is that in which simple jigs are made and the gear center-holes are drilled and reamed. This method is accurate, but it is limited to small-sized gears and holes. In cases where small quantities are involved, it can be employed on jig-boring machines.

When small lots are required and the axes of the holes to be produced are in one plane, a very useful device is the false plate shown applied in Fig. 2. The work-piece is provided with a hole for locating it on the false plate *A*, which has two holes in it for engaging locating pins. A fixed plate with a number of holes in it is placed below the false plate. The holes in the fixed plate are so disposed that when the top plate is adjusted to bring the two holes *B* into alignment with two holes in the lower plate, the component is in line for boring. The coincidence is checked by plug gages. Arrangements can be made to suit any angle between the axes of the holes, but the holes must all be at the same height.

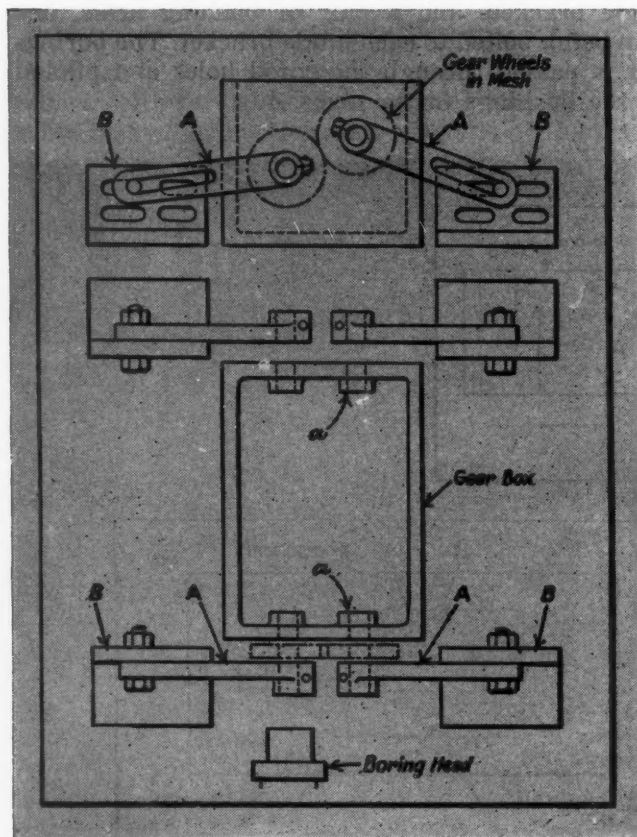
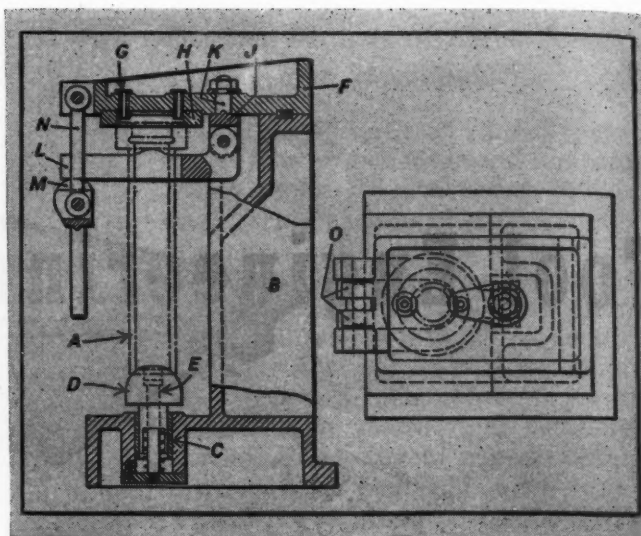


Fig. 3. Meshing Gear Method of Positioning Gear-box for Boring Shaft Holes



Jig Designed for Use in Drilling Two Holes in Flange at Upper End of Sleeve A

Jig for Drilling Sleeve Flanges

The part shown by dot-and-dash lines at *A* in the accompanying illustration is a steel connecting sleeve which has previously been bored, turned, and faced. The operation to be done in the jig illustrated is the drilling of two holes in the flange. The body of the fixture *B* is made of cast iron and is fitted to the table of a radial drilling machine. Contained in the body is the liner bushing *C*, which acts as a bearing for the spring-loaded ball center *D*. This center locates the work by engaging the previously bored hole, and a shrouded screw at *E* is provided to keep the center *D* in position.

The cast-iron bracket *F*, in which the drill bushings *G* are located, is keyed and fastened to the top face of the body. The inside face of the bracket is recessed to receive the hardened and ground steel ring *H*, the tapered bore of which enables the work to be accurately centered. A U-shaped block *J* is located in the bracket by the shank *K* and secured by a nut and washer.

Coupled to the block *J* is the forked clamp *L*, which is pressed against the under side of the flange on the sleeve by the action of the cam *M*. A slot cut in the cam permits the entry of one end of the link *N*, which is retained by a pin. The other end of the link is pivoted between the lugs *O*.

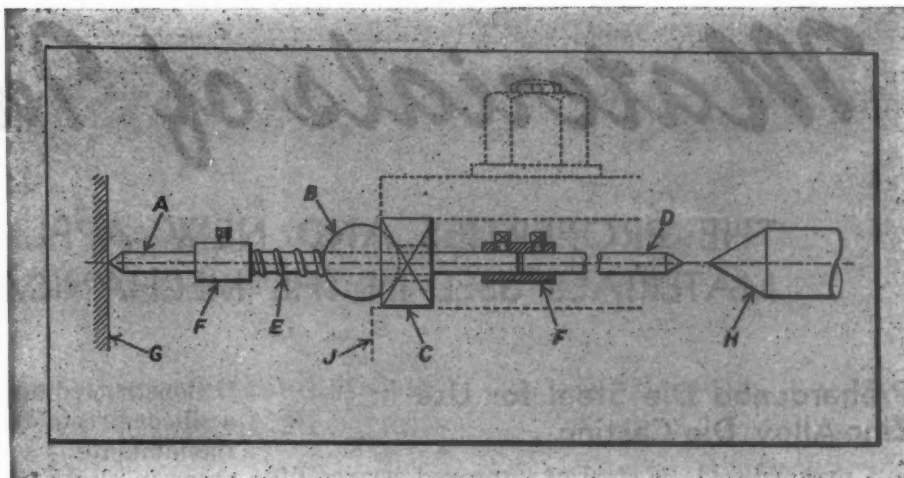
Centering Device Used in Positioning Work Drilled in Lathe

The centering device shown in the accompanying illustration was designed to facilitate the drilling of accurately positioned holes in the lathe. It is used for aligning the center or prick-punch mark in the work with the drill which is to be held in the tool-holder of the lathe. The device, called a "wabbler," consists of a centering needle *A*, a ball *B*, and a holder *C*, together with the extension *D*

Work Aligning Device Used in Lathes to Insure Accurate Positioning of Drilled Holes

(preferably of aluminum), a compression spring *E*, and the two collar-rings *F*.

The holder *C* is clamped in the lathe tool-holder, and by means of ball *B*, the needle *A* is slightly pressed against the center mark in the work *G*. If the adjustment is off center, the pin *D* of the extension will be out of line with the tailstock center *H*, and readjustments must be made until the proper alignment has been obtained.



Milled Parallels for Holding Work on Magnetic Table of Grinding Machine

By FRANK HORACK, North Tonawanda, N. Y.

Work-pieces having projections on one face and a flat surface on the opposite face can be conveniently held for flat surface grinding by means of the parallel adapters shown in the accompanying illustration.

A pair of cold-rolled steel parallels are milled as shown. The feet or pads on one of the parallels are machined to bridge the positive fields and contact

the negative fields of the top of the magnetic table, while the feet of the other parallel are made to match the positive fields of the table top. The parallels are placed on the magnetic table of the grinding machine, and the work to be ground is put on the parallels as shown in the illustration.

* * *

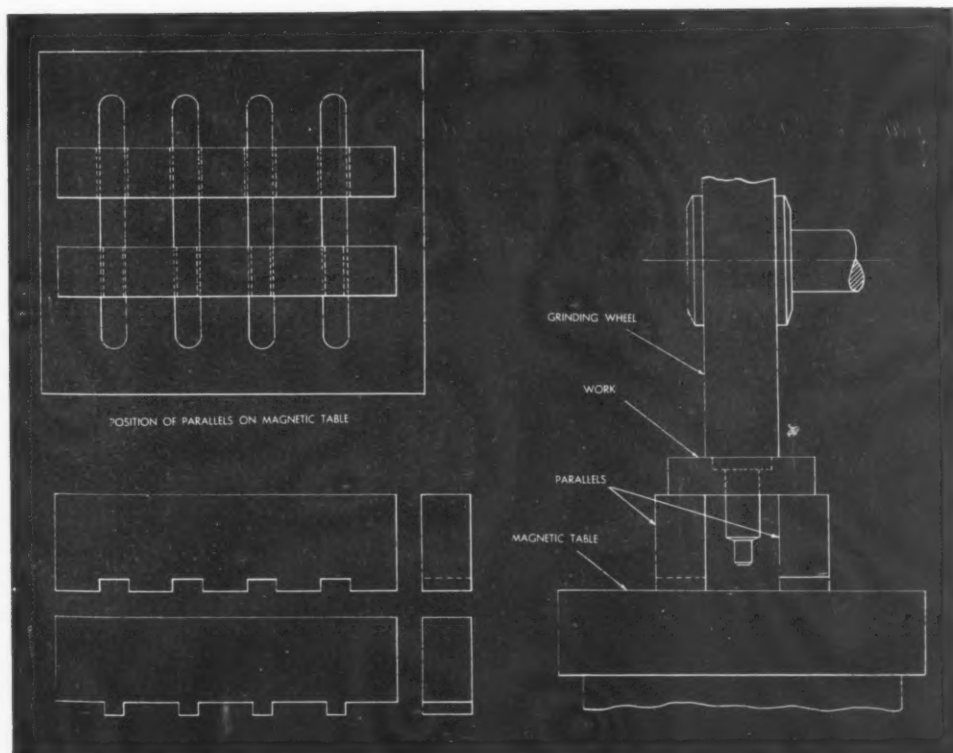
Better Manufacturing Methods Must be Devised to Compensate for Higher Wages

The successful efforts of the Government and labor leaders in increasing the cost of living, through the higher prices necessitated by increased wages, place a difficult task on the shoulders of engineers and manufacturers. These men must now find means, by improved manufacturing machinery and methods, to so reduce the cost of goods produced that labor will gain some real benefit from the increased wages. If manufacturing costs cannot be reduced to compensate for the increased labor costs, then the workers who have received increases in pay will gain no real benefit, and the general public will actually suffer because of the increased cost of living.

* * *

High-Strength Wire

For use in the construction of military aircraft, the U. S. Steel Corporation developed a special wire, 0.050 inch in diameter, with a guaranteed minimum tensile strength of 290,000 pounds per square inch.



Parallels Employed for Holding Irregular-shaped Work on the Magnetic Table of a Grinding Machine

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Prehardened Die Steel for Use in Zinc-Alloy Die-Casting

A prehardened die steel of improved service life and machinability for use in zinc-alloy die-casting has been announced by the Heppenstall Co., Pittsburgh, Pa. The new die steel, known as "Silver Hardtem," is being produced in the form of die-blocks, as well as die-block bars and inserts. Being prehardened, it requires no further heat-treatment by the user, thereby eliminating the possibility of breakage or warpage. The final grinding usually performed when dies are hardened after the impression has been machined is also eliminated.

This die steel can be furnished in any desired hardness. It is claimed that dies made of "Silver Hardtem" do not load or become mutilated at the parting line, and the necessity for removal from casting machines for surface repair is said to have been minimized. This is reflected directly in reduced casting machine "down time.".....201

New General Electric Plastic Shows Improved Qualities in Heat Test

After one week's baking over a hot oven, the General Electric Co.'s new chemical compound, silicone glass laminate, has continued to show improved mechanical and electrical properties. The new plastic has far surpassed any similar product by withstanding the week-long test at 250 degrees. Still more severe heat tests are planned to obtain further data on the qualities of this material.

Constructed of layers of glass cloth, treated with a silicone resin and subjected to heat and pressure, the laminate is so resistant to heat that whole new areas in electrical insulation may be opened up.

Many applications for silicone glass laminates are being found in such electrical equipment as motors, circuit-breakers, induction heaters, high-frequency oscillators, and other electrical and electronic equipment. Other uses may include handles for arc-welding electrodes and indestructible insulating parts for devices subject to fire hazards. The new compound is somewhat heavy for a plastic material, as it weighs about the same as magnesium. 202

Heavy-Duty Floor Cleaner Developed for Cement and Tile Floors

A heavy-duty floor cleaning compound known as Optimus floor cleaner No. 1F10 has been developed by Optimus Detergents Co., 158 Church St., Matawan, N. J., for use on cement, Terazzo, or tile floors. This compound is effective in removing oil, grease, and dirt from the surface, but does not harm the finish of the floor. Regular washings with Optimus floor cleaner have been found to keep floors in good condition, making them less porous and free from a "dusting" tendency. The compound consists of a base from which a liquid floor cleaner can be made, or it can be applied to the surface directly and then rinsed off. It is effective in industrial floor scrubbing machines when used in the lower concentrations.203



This 4-inch Thick German Tank Armor was Pierced at an Angle of 45 Degrees by the Carboly Core of the Armor Piercing Projectile Shown on the Table at Front of Illustration

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Potter & Johnston Automatics Improved by Continuous Development Program

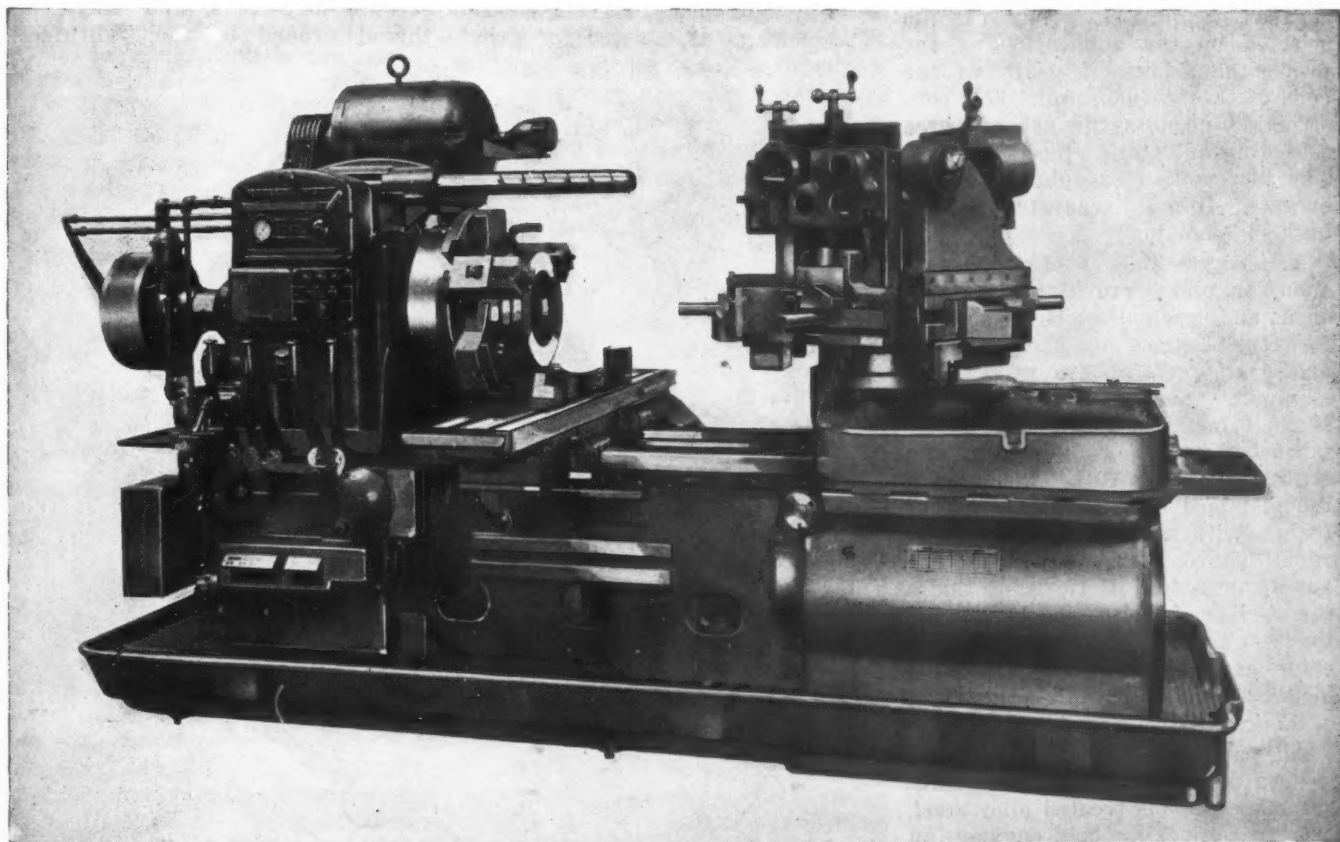
Since its early pioneer work in the design of automatic machine tools, more than forty years ago, the Potter & Johnston Machine Co., Pawtucket, R. I., has consistently engaged in the progressive development of this important class of production equipment. During the last four years, many major and minor improvements have been incorporated in this company's automatic chucking and turning machines and automatic turret lathes. These improvements, not previously announced, have in a large measure been incorporated in the Model 6 DREL automatic shown in the accompanying illustration. This machine gives some idea of the extent to which new features and im-

provements developed to meet the exacting demands of the last four years have been incorporated in the regulated line of Potter & Johnston automatic machine tools now available.

The operating cycle of the machine illustrated is completely automatic, from the time the work is manually chucked until the knock-off mechanism operates at the end of the machining operation. This automatic control includes all changes of speeds and feeds, the manual controls being used for setting-up purposes only. Complete changes of set-up are effected on this machine without changing cams. The number of these machines that can be efficiently

handled by one operator depends on the relation of the chucking time to the time cycle required for the completion of the work, two to four units usually being assigned to each man.

The speed and power available on this machine are adequate to utilize the full cutting capacities of present-day tungsten-carbide tools. Power and rigidity, together with the automatic changes of spindle speed, selective automatic changes of feed, automatic binding of the turret following indexing, direct cross-slide action, and constant high-speed motor-driven fast motion for the cross-slide and turret-slide are features contributing toward maximum production.



Potter & Johnston improved Automatic Chucking and Turning Machine

There are twenty changes of speed ranging from 9 to 167 R.P.M. A high-speed motor is also available, which has a spindle speed range of 12 to 305 R.P.M. These speeds are arranged in five sets of four automatic changes. Any group of the four automatic changes can be quickly obtained by the application of the proper set of hand pick-off gears, which are located in a compartment at the end of the headstock.

Speed and feed change clutches are provided which can be operated either manually or automatically through the medium of control dogs. The automatic operation of the clutches is accomplished by the action of pneumatic cylinders. The flow of air to these cylinders is timed by solenoid-operated valves, which are controlled by the dog drum. All changes of speed and feed are readily made while the machine is under the cutting load. The dogs are not subjected to strains, but simply serve to select the feed or speed required.

The gears that control the feed changes are located in a feed-box at the rear of the base. The gears in this unit are alloy steel and run in oil. There are twenty-four feeds arranged in geometric progression from 0.007 to 0.089 inch per spindle revolution or from 0.007 to 0.250 inch per spindle revolution. These feeds are arranged in three groups. A feed from each group can be selected by the application of the proper hand pick-off gears on the ends of the feed-box unit. This construction permits the use of three selective automatic feed changes. The fast motion or quick return is operated from a separate constant high-speed motor.

The turret-slide is of rigid construction, and is provided with hardened and ground steel inserts to form its bearing on the hardened and ground steel base ways. The maximum travel of the turret-slide is 28 inches, and the minimum distance between the spindle nose and the turret face is 10 1/4 inches with the standard cross-slide, and 9 1/4 inches with the heavy-duty cross-slide. The 6 DREL model machine has a turret feed of 13 inches and a turret-slide adjustment of 10 1/8 inches. The 6 DRELX model machine has a turret feed of 22 1/4 inches and a turret-slide adjustment of 17 inches.

All parts of the turret-revolving Geneva mechanism subject to strain are made of heat-treated alloy steel. The turret-locking bolt engages an index-plate of large diameter and operates between an adjustable taper

gib and a hardened and ground steel plate which insures accurate, positive positioning. The turret is of liberal dimensions, and is automatically clamped in position after indexing. A five-faced turret is standard for the 6 DREL model, but four- or six-faced turrets are available. A six-faced turret is standard for the 6 DRELX model.

The standard cross-slide is 10 1/4 inches wide, but a special heavy-duty cross-slide with a width of 12 1/2 inches is also available. The cross-slide cam-drum is located under the cross-slide, and the ball-bearing cam-roll studs are mounted in the cross-slide. The cross-slide travel is 8 1/2 inches each way on the 6 DREL machine, and 6 1/4 inches on the 6 DRELX machine. The swing is 21 inches over the cross-slide and 34 1/4 inches over the bed.

The timing box, located at the rear of the machine and directly below the turret-slide, is coupled to the feed-shaft and transmits power to the turret cam-drum and the cross-slide cam-drum. It maintains

a fixed relationship between the operation of the cross-slide and the turret-slide throughout the entire machine cycle. This relationship can be changed by simple adjustment of the timing mechanism.

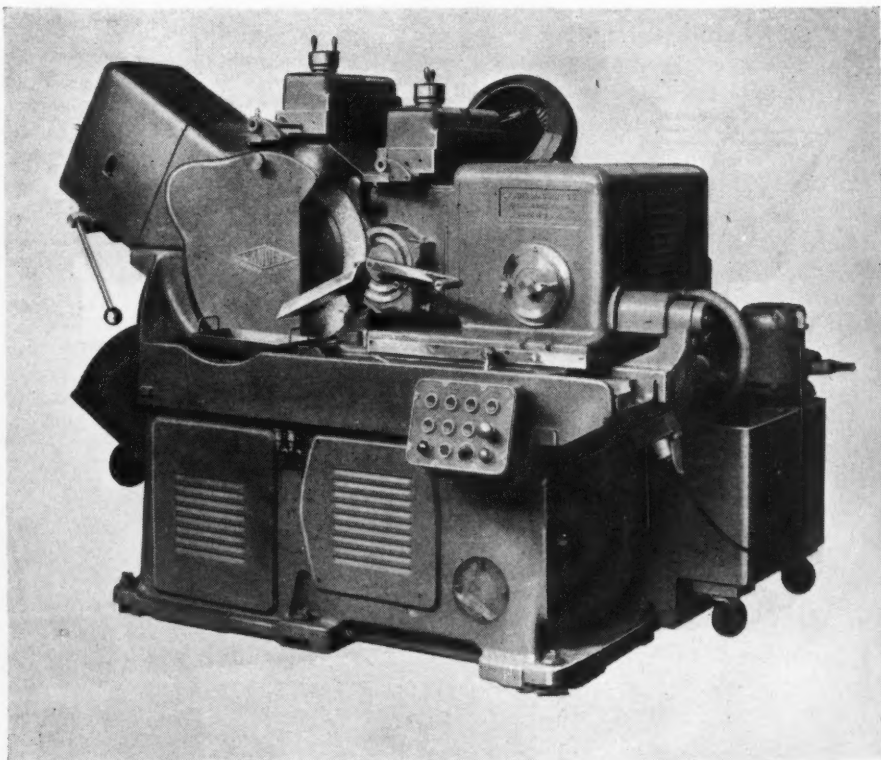
A combination oil filler and oil level indicator is provided on the front of the headstock. A rugged overhead pilot arrangement is available if required. There is a push-button panel on the front of the headstock, and an air control box containing the air valve and the air-pressure gage is located directly above the push-button panel. A push-button control of the fast motion motor is mounted on the headstock for use in setting up the machine. The main drive is by multiple V-belt from the main driving motor. These machines are equipped with constant-speed driving pulleys which simplify motor application. A motor-driven centrifugal coolant pump at the head end of the base pan operates only during the cutting time, and is controlled by a switch, operated by dogs on the control drum...61

Landis Centerless Thread Grinder

A new universal centerless thread grinder announced as a post-war product of the Landis Machine Co., Waynesboro, Pa., in January, 1944, is now being placed on the market. This machine is adapted for grind-

ing screw threads on straight cylindrical work, as well as on headed or multiple-diameter parts.

Single-diameter work, such as set-screws, long rods, and rings, are thread ground by the "Thrufeed"



Landis Universal Centerless Thread-grinding Machine

process, the pieces being passed in a continuous line between the grinding and regulating wheels. This process, can be used either to grind threads from solid blanks or to finish threads that have been precut or rough-formed.

Headed or shouldered work, such as cap-screws, headed adjustment screws, stripper bolts, and similar multiple-diameter parts are centerless thread ground by the "Infeed Method," which completes the entire thread in about 1 1/2 revolutions of the work. The work is placed between the wheels, one piece at a time, and is automatically ejected at the completion of the thread grinding operation. This method can also be used for grinding either precut threads or for grinding threads in solid cylindrical pieces, and is frequently employed when the threads are required to be concentric with an unthreaded portion of the work.

The grinding and control wheels can be dressed without disturbing the set-up, and when the machine is equipped with an extra coolant tank, a complete change of coolant can be made in a few minutes. The grinding wheel is driven through V-belts by a constant-speed 15-H.P. motor, mounted on a hinged structure that provides a convenient means for adjusting the belt tension without the use of idlers. The control wheel spindle rotates on precision preloaded ball bearings, and is mounted in a swiveling housing. An electronically controlled drive provides an infinitely variable working speed range to the control wheel and a preselected fixed speed for dressing the wheel.

A profile diamond type dresser is mounted over the grinding wheel, and a similar dresser is positioned over the control wheel. Each dresser can be equipped with a profile cam for forming the face of the wheel to any desired contour. When only straight faces are required on the wheels, the profile cams can be locked out of engagement to permit the dressers to function as simple diamond tools.

A heavy-duty automatic crush-dresser is attached directly to the bed of the machine for use in producing the thread forms on the grinding wheel. A geared motor is incorporated in the dresser for driving the crusher roll and the grinding wheel at a slow dressing speed. The motor control is interlocked with the main driving motor controls to prevent contact between grinding wheel and crusher roll when the grinding wheel is rotating, thus avoiding

damage to the crusher roll through any error in operation of the machine. The mechanism in the crush-dresser permits preselecting the depth of penetration when crushing, so that the dresser is automatically stopped when the desired penetration is reached.

The large micrometer handwheel built into the upper slide for size

adjustments reads to 0.0001 inch on the diameter of the work-piece, and can be set to the zero position at any time. The handwheel is used for making corrections for wear on the grinding and control wheels.

An automatic hopper is available for feeding work-pieces such as headless set-screws and short rods for "Thrufeed" grinding.62

"Sip" Profile Projector and Universal Measuring Apparatus

The new AP-10 profile projector, shown in Fig. 1, and the universal measuring apparatus MU-214B, illustrated in Fig. 3, were among the large group of precision machines and instruments built by the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, which were exhibited by the Cosa Corporation, 5000-4 Chrysler Bldg., New York 17, N. Y., at the recent show in Cleveland.

The profile projector is the result of fifteen years' experience in building projectors for precision gaging work. A wide capacity and versatility, combined with high accuracy and luminosity of the silhouette or surface projections, are outstanding features of this projector. The change-over from one magnification to the other is readily accomplished by simply rotating the turret through an angle of 90 degrees. The illuminating lamps are normally operated at low voltage, full voltage being applied only when actually making observations. This method of using the lamps serves to practically double their useful life. The disk carrying colored filters is built into the head of the projector to supply successive illumination of the screen in white, green, or orange light, as desired.

The object table is fitted with a glass stage 2 3/4 inches in diameter and with micrometer-operated cross-slides for making measurements in rectangular coordinates. It can be displaced vertically by means of a handwheel, accurate focussing of the image on the screen being provided by a slow-motion adjusting knob. A tilting center support can be supplied for gaging cylindrical plain or threaded parts up to 8 5/8 inches in length and up to 2 1/2 inches in diameter. Magnifications of 10x, 20x, 50x, and 100x are available. Silhouette projections are accurate to 1/1000 and surface projections to 1/5000 of the nominal value. The screen surface is 17 3/4 by 22 inches, and the object table 5 1/2 by 5 5/8 inches. The micrometer drums read

to 0.0005 inch. Over-all dimensions of the projector are 37 1/4 by 30 1/2 by 70 1/2 inches, and the weight is 600 pounds.

The universal measuring apparatus has been developed to provide a standard means for checking all measurements, including the inspection of master and shop gages. It is adapted for checking flat, cylindrical, plain, and adjustable snap gages, thread and taper gages, rules, templates, jigs and tools, as well as component parts of all kinds. Work of relatively large size and weight can be accommodated on the regular cast-iron table.

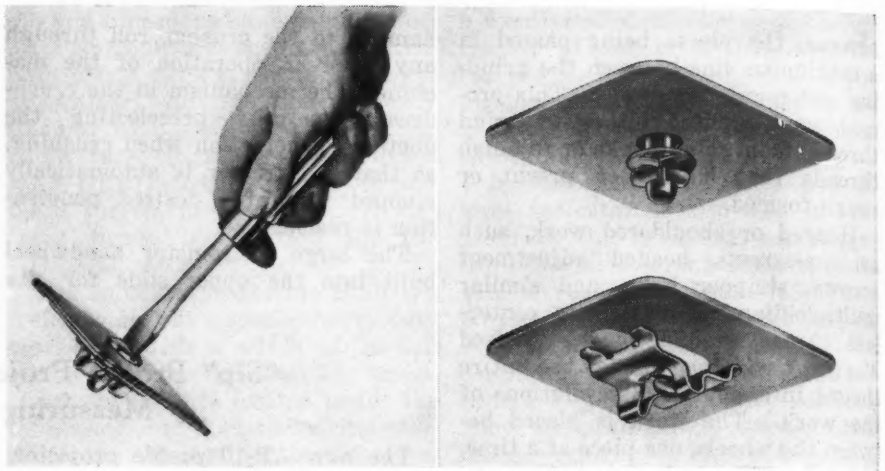
Measurements in rectangular coordinates can be made in the horizontal plane to within 0.00005 inch. The



Fig. 1. "Sip" Profile Projector Placed on the Market by the Cosa Corporation

standard scales are made of rust-proof steel alloy material, and are accurately calibrated, the value of each sub-division being given to within 0.00001 inch. The reading microscopes are provided with a pair of parallel lines for accurate settings of the division of the standard scale, and have graduations for reading to 0.005 inch. The micrometer drum, divided into one hundred parts, each of which represents 0.00005 inch, provides means for adjusting the reticule over one division in the eyepiece. Green light illumination is provided for the microscope field.

Vertical measurements can be made by direct readings from 0 to 3/4 inch by means of the vertical microscope with built-in divided scale. The measuring range, however, can be increased to 6 inches by using gage-blocks in conjunction with the microscope. Measurements in polar coordinates can be made roughly and accurately on the precision rotary table, angular readings being made to ten seconds of arc on the vernier of the graduated drum mounted on the worm which controls rotation of the table. A large number of adjustments are available for precision inspection work, including the checking of internal and external threads and racks.63



Quick-operating "Q-Two" Fastener for Sheet-metal Panels
Made by Shakeproof, Inc.

Shakeproof Quick-Operating Fastener

A light-duty, quick-operating fastener designed for use on removable and hinged panels where accessibility for inspection, oiling, adjusting, cleaning, or servicing is required has just been introduced by Shakeproof, Inc., 2501 N. Keeler Ave., Chicago 39, Ill. This fastener, known as the Shakeproof "Q-Two," has been especially designed to simplify installation and reduce costs. It consists of

a stud, which is held on the outer sheet by a special spring washer, and a receptacle which can be easily snapped on dimpled inner sheets or frames. Features of this fastener include allowance for variations in sheet alignment up to 1/8 inch, compensation for variations in sheet thicknesses, elimination of rivets and screws, and positive locking with a one-quarter turn of the stud.64

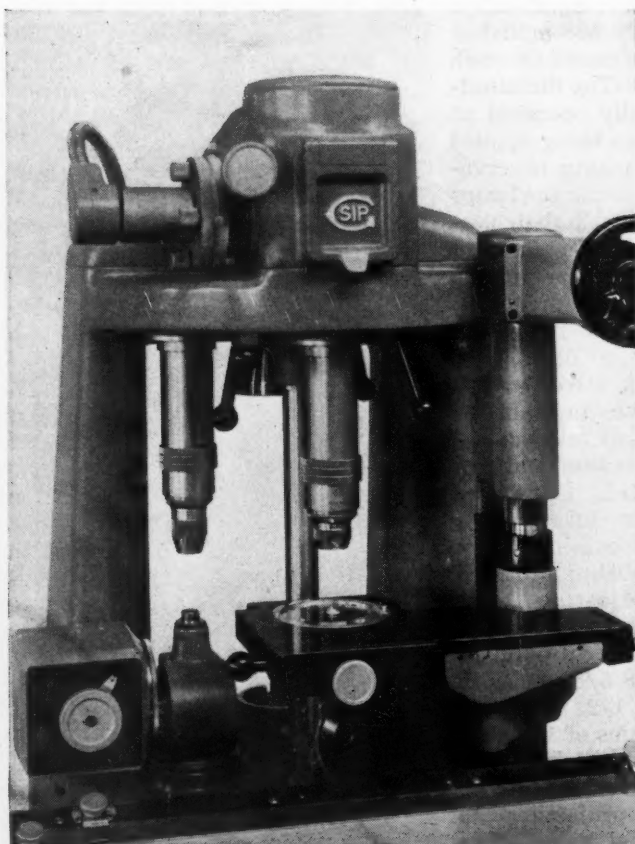


Fig. 2. Close-up View of Object Table and Turret with Objectives and Condensers of Profile Projector

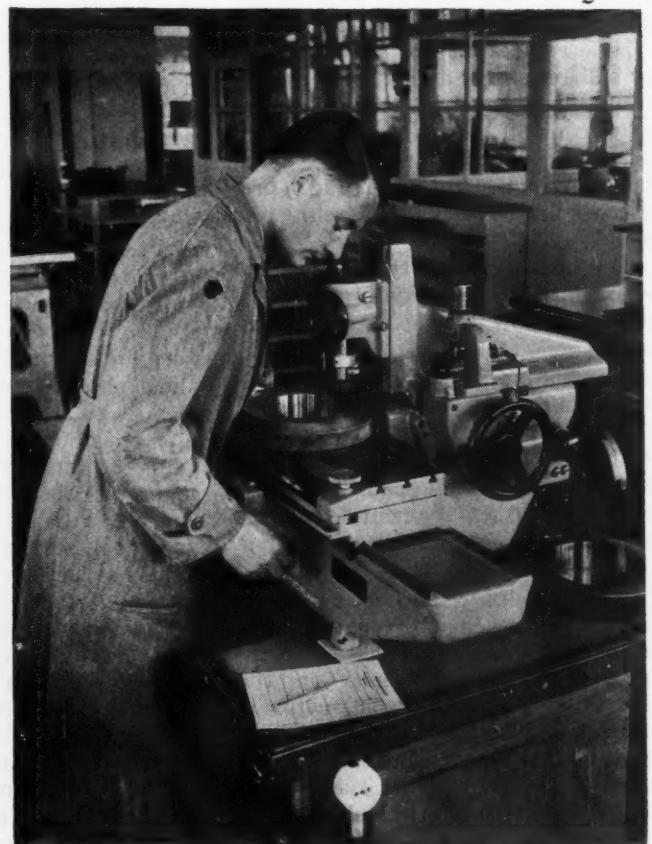
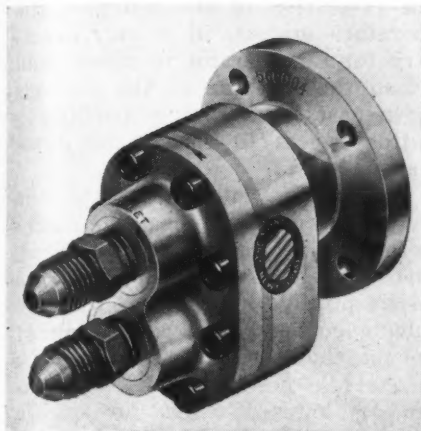


Fig. 3. "Sip" Universal Measuring Apparatus Introduced in This Country by the Cosa Corporation



Pressure Lubrication Pump Built by the McIntyre Co.

McIntyre Pressure Lubrication Pump

A Series 1200 pump designed for pressure lubrication of the bearings of machine tools, Diesel engines, turbines, generators, and other high-speed and heavy machinery, and for fluid handling in aircraft at high altitudes, has been developed by the McIntyre Co., 200 Riverdale Ave., Newton 58, Mass. This direct-drive gear pump is a small 8-ounce unit, operating with a volumetric efficiency of 95 per cent. Three standard models displace from 0.08 to 1.5 gallons per minute at speeds ranging from 1140

to 3450 R.P.M. against pressures up to 150 pounds per square inch.

The standard models are designed for direct motor application, but pumps can be furnished for flange

mounting, belt, spline, and other drives. Power requirements vary between 1/100 and 1/6 H.P. The pump body is made of aluminum, with Nitralloy gears and shafts.65

H-P-M High-Pressure Die-Casting Machines

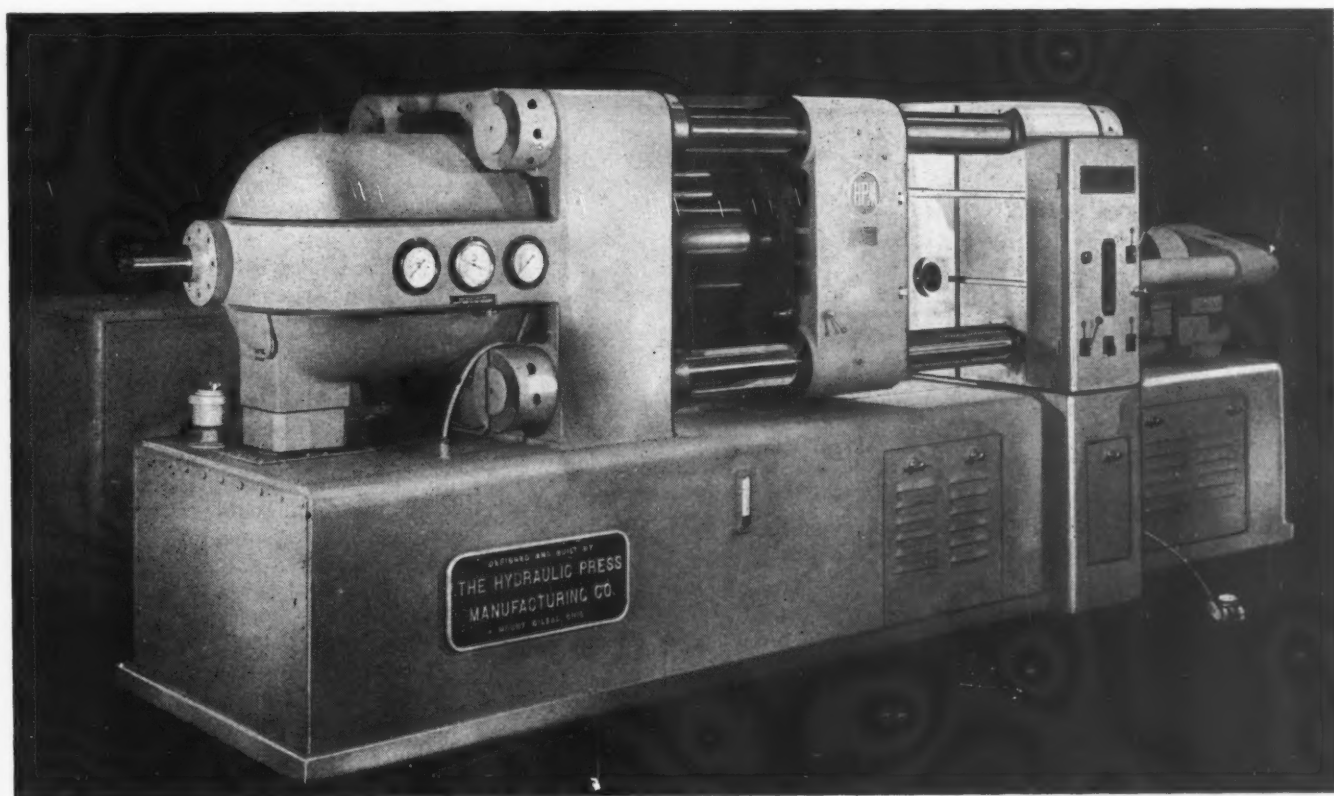
The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has brought out two high-pressure die-casting machines that employ the cold-chamber process for casting magnesium, aluminum, and copper alloys. These self-contained machines are of radically new design in that the mold-clamping, metal-injecting, core-pulling and work-ejecting units are all operated by direct hydraulic means. With these high-pressure machines, the metal is kept in the molten state in a conveniently located furnace, from which the operator ladles it into an opening leading to the injection cylinder commonly called the "cold chamber." The advancing injection plunger displaces the metal in the cylinder and forces it into the closed mold.

The injection capacities of these high-pressure die-casting machines range from 12 1/2 to 100 cubic inches per cycle. Injection pressures range from 6000 to 50,000 pounds per square inch, depending upon the diameter of the plunger used. The

two standard models in production are the 400-A machine for casting aluminum, and the 400-M for casting magnesium. The basic difference between these models is in the operating speed of the injection plunger.

The plunger of the magnesium-casting machine is actuated by a nitrogen accumulator or "bottle" which provides injection speeds up to 7200 inches per minute. Since the injection speed of the magnesium-casting machine is adjustable, it can be used for die-casting other alloys. The aluminum-casting machine employs straight-line hydraulic power, the injection ram being directly connected to the H-P-M Hydro-Power radial pump. The maximum injection speed of the aluminum-casting machine is 750 inches per minute.

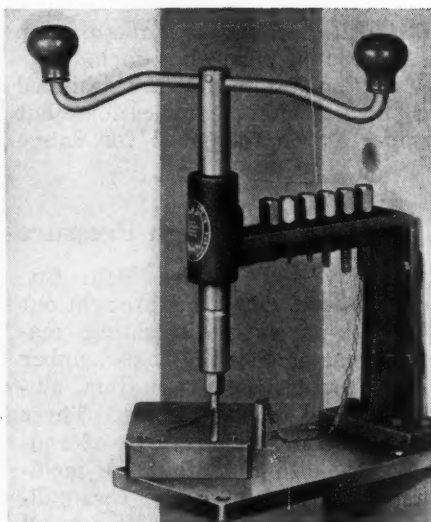
One of the most outstanding design features of these new machines is the straight-line hydraulic clamp used to seal the mold halves during the injection part of the machine cycle. The double-acting main ram is equipped with a small internal



High-pressure Die-casting Machine Built by the Hydraulic Press Mfg. Co.

booster ram which provides for rapid advance of the movable half of the mold. Just prior to the contacting of the mold halves, the closing speed is automatically reduced to eliminate or lessen the shock to these members. The clamp pressure, clamp stroke, and timing of the slow-down action are all adjustable. No locking devices are required to hold the mold halves in the closed position.

Control of the machines is semi-automatic, the operator starting each cycle by means of an electrical foot-switch. The remainder of the cycle is automatic, but manual controls are provided to permit operating each unit independently.66



Dahlstrom Tap-guiding Fixture

Fixture Designed to Reduce Tap Breakage

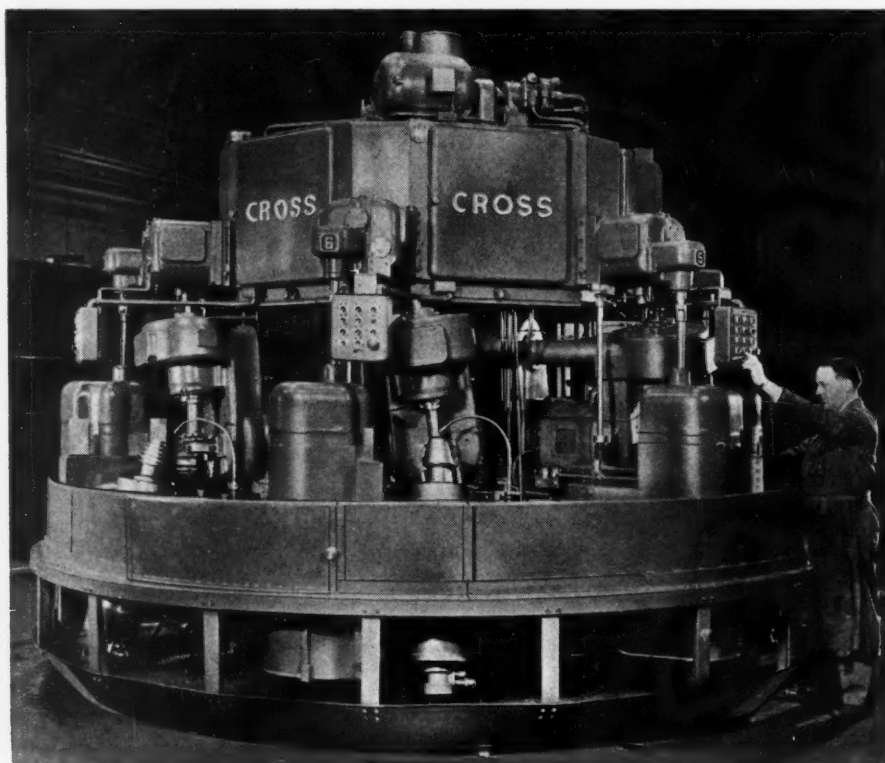
A tap-guiding fixture recently brought out by the Dahlstrom Mfg. Co., 420-H S. Sixth St., Minneapolis 15, Minn., is designed to eliminate breakage of taps, reduce the time required for tapping, and insure the

production of straight, true threads. The fixture can be fastened to a post or bench, and can be used by inexperienced operators. It is furnished with seven adapters for tapping threads ranging in size from 8-32 to 1/2 inch.67

Cross Rotary Thread-Milling Machine

A specially designed machine for milling the taper threads on nineteen different models of oil drill cutters has been brought out by the Cross Co., Detroit 7, Mich. This machine has six self-contained inde-

pendent work stations mounted on a circular bed which is provided with a variable rotary feed. The feed is so timed that each station automatically completes the milling operations on one piece of work during



Cross Rotary Machine Designed to Mill Taper Threads on Oil Drill Cutters

one revolution of the bed past the operator's station. It is only necessary for the operator to unload and reload the machine as the stations move past him. Simply pushing a button serves to repeat the automatic cycle.

During the automatic cycle, the motor-driven milling head approaches the cutting position at a fast feed. The work-head spindle feeds the piece spirally upward into the revolving cutter. Upon completion of the cut, the milling head moves back to the idle position and the work-head is lowered while the spindle reverses. Production on this machine ranges from twenty to forty oil drill cutters an hour, depending on the thread length.68

Reed Thread-Rolling Machine

The Rolled Thread Die Co., 237 Chandler St., Worcester 2, Mass., has recently developed a Model A22 thread-rolling machine in which important improvements have been incorporated. One of the outstanding features of this new machine is the exceptionally rugged mechanical feed for the thread rollers. The machine has been designed for the production of uniformly accurate knurls, serrations, and other types of formed and burnished surfaces, as well as screw threads.

The unusual range and flexibility of this machine make possible the economical production of threads on a large variety of hollow parts, short-length threads on top-heavy parts, tapered threads, threads close to shoulders, and threads on many other parts made of materials ranging from soft, non-ferrous metals to semi-hard alloy steels. It is suitable for both large and small quantity lots.

Adjustable scroll rings in the head provide for approximate setting of the dies, while the final sizing of the work is easily obtained by a micrometer adjustment. A wide range of die and cam speeds, in conjunction with interchangeable cams, affords any cycle of "squeeze," dwell, and release required for different materials, work, and thread or form specifications.

Standard die-holders are available for rolling threads ranging from 1/4 inch to 2 5/8 inches in diameter and up to 1 1/2 inches in length. Holders for rolling threads over 1 1/2-inch lengths can be supplied for certain thread forms. Change-gears are available for seven differ-



Reed Cylindrical-die Thread Roller

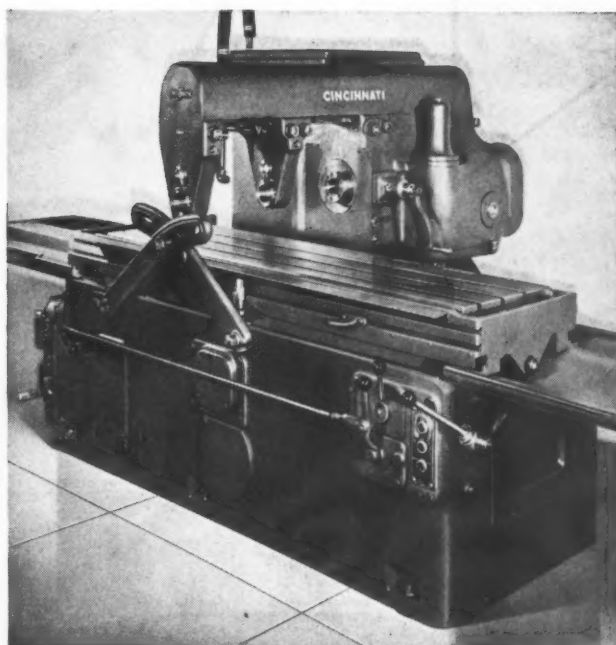


Fig. 1. Cincinnati Plain Hydromatic Milling Machine

ent die speeds ranging from 110 to 720 R.P.M. A 7 1/2-H.P. 1800-R.P.M. motor of the open type is used for the drive, the motor and controls being wired for 220, 440, or 550 volts, two- or three-phase 60-cycle operation. The machine requires a floor space of 30 by 46 inches, and weighs 3200 pounds.....69

Cincinnati Plain and Duplex Hydromatic Milling Machines

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has announced a new line of Hydromatic milling machines, of much heavier and more powerful design than previous models. Increased cutting

capacity and higher spindle speeds adapted for high-speed carbide milling are outstanding features of these machines. Like the models they supersede, the new machines are of bed type construction, with automatic table feed cycles and infinitely variable hydraulic table feeds.

Standard machines of this line are built in the plain style shown in Fig. 1 and the duplex style illustrated in Fig. 2. They are made in twelve sizes, ranging from the No. 3—24 machine with a table traverse of 24 inches, which is equipped with a 7 1/2-H.P. motor, up to the No. 56—90 machine with a 90-inch table traverse, which is driven by a 30-H.P. motor. More powerful motors in the proper frame size can be used for special applications.

The principal castings, such as those used for the bed, table, headstock, and spindle-carrier of the machines, are exceptionally heavy. The table width has been increased 2 inches to provide a larger work and fixture clamping area. The ways are also square-gibbed to obtain greater accuracy and rigidity. A much heavier drive with wider faced gears, larger shafts and bearings, and a much heavier spindle are among other improvements incorporated in the new machines. The flywheel effect, so desirable in high-speed carbide milling, is provided by using a much larger bull gear on the spindle. A smooth flow of power to

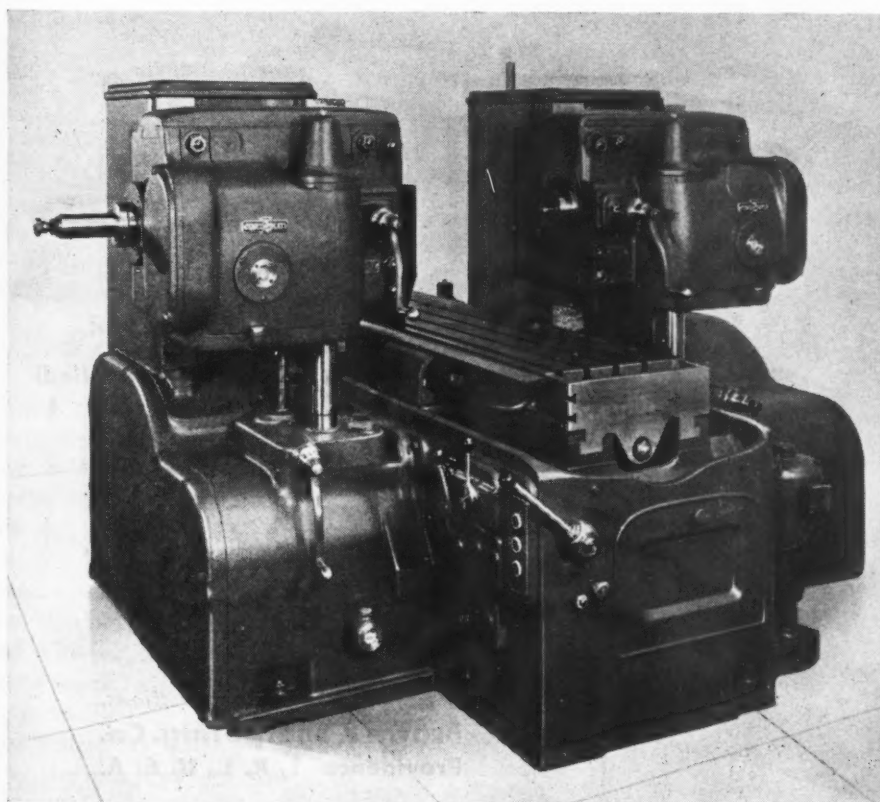


Fig. 2. Cincinnati Duplex Hydromatic Milling Machine

To obtain additional information on equipment described on this page, see lower part of page 236.

NON-
CUTTING
TIME

CUTTING
TIME

48 of every 60
is CUTTING TIME

On the two jobs illustrated at right, Automatic Indexing Fixtures keep the cutters of the No. 12 Plain Milling Machine cutting over 80% of the operating time - at more than 4" feed per minute. Operator mounts work on an extra set of arbors while machine is cutting. Machine automatically stops after final cut, for reloading.

**No. 12
PLAIN
MILLING
MACHINE**

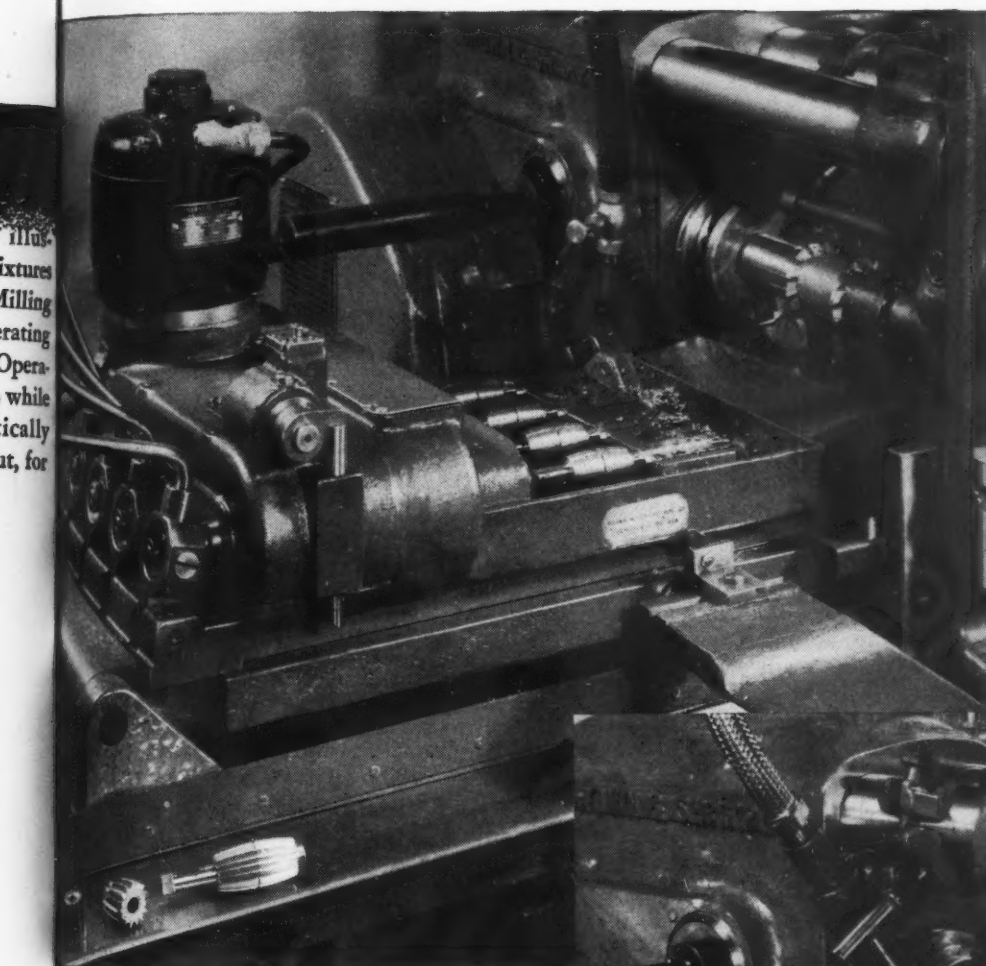
(Electrically Controlled)



Write for detailed specifications.
Brown & Sharpe Mfg. Co.
Providence 1, R. I., U. S. A.

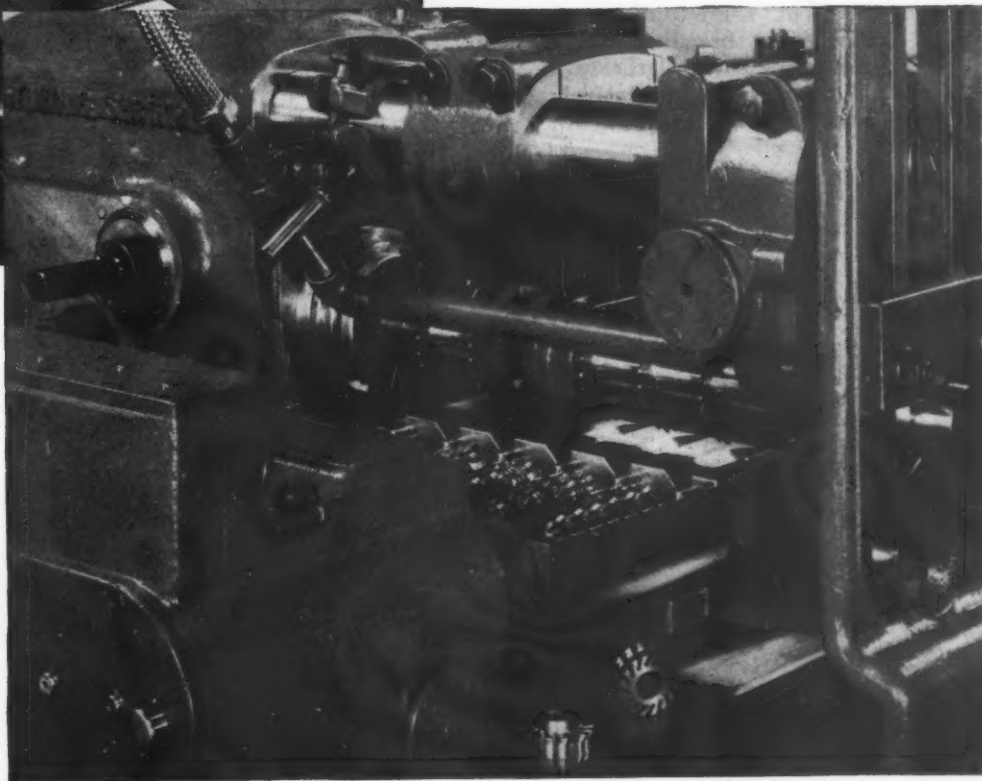
BROWN &

60 Minutes Time on No. 12... WITH THESE 2 SET-UPS



Here grooves are being milled in boiler tube cleaners—eight pieces at a time. Work is automatically indexed after each cut. Climb milling is employed to force the work against the rigid center, and to provide a sharp edge (without burrs) on the teeth. The curved contour of the teeth is obtained by means of cams which guide the tilting fixture as it passes beneath the cutters. Indexing mechanism is operated by a torque motor connected to machine circuit.

This set-up shows teeth being cut in cutters used in shoe manufacturing. Cutters are mounted in gangs on six arbors, each arbor being indexed automatically. To eliminate cutter drag on the return stroke, the spindle head is raised automatically for return stroke and, after dropping back into position for the next cut, is automatically clamped. The indexing mechanism, head elevating mechanism, and arbor yoke clamping mechanism are air-operated, and controlled by solenoid air valves wired to the machine circuit.



SHARPE

the spindle is assured by employing spiral, bevel, or helical gears for the entire speed transmission, including the pick-off gears.

An innovation in design is found in the construction of the over-arm, which is much heavier than in preceding models and has a built-in unit which arrests vibration at the out-board end of the arbor and greatly reduces the need for supplementary support through the arbor braces. A choice of seven ranges of spindle

speeds is available. The highest speed group ranges from 164 to 1225 R.P.M. for small spindle-carriers; from 137 to 1000 R.P.M. for medium spindle-carriers; and from 110 to 820 R.P.M. for the large size. Eight speeds are available in each range.

Electrical controls are built into a compartment in the right-hand headstock and are provided with safety features. The work of starting and stopping the spindle rotation is performed hydraulically.70

Jones & Lamson Automatic Self-Opening Die-Heads and Ground-Thread Flat Rolling Dies

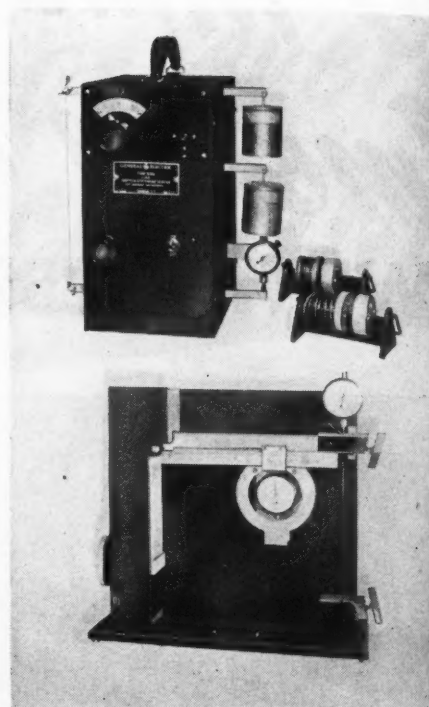
The Jones & Lamson Machine Co., Springfield, Vt., has just introduced a new high-speed automatic self-opening die-head of the radial chaser type shown in Fig. 1. This die has a threading capacity range from 2 1/2 to 4 inches for heavy-duty threading, and up to 4 1/4 inches for threads of 8 pitch and finer. It is hardened and ground on all working surfaces.

The chasers of this die are ground in the thread form after hardening, and are guaranteed to hold their lead accuracy to within 0.001 inch per inch of length. The accuracy of the form, as well as the correctness of the lead, is adequate for the production of threads to specifications of Class 3 fit, American National Standards. The built-in eccentric "float" combined with the longitudinal "float" serve to make this a very satisfactory threading tool for heavy saddle type turret lathes.

The ground-thread flat rolling dies shown in Fig. 2 are another new

product of this company. The dies are designed for use on Waterbury Farrel, Manville, National Bolt-maker, and National Electric Jr. and Sr. thread rolling machines. The maximum length to which these ground-thread dies are now made is 10 inches, which is equivalent to that of the No. 40 Waterbury Farrel dies. The dies can be supplied in any width up to 8 inches.

A standard type of starting and leaving end for the ground threads has been established for the shorter dies. These starting ends and the thread form are ground into the die in one operation on thread grinders built especially for the purpose. All dies are matched and can be set up quickly. The accuracy with which these dies are made assures even distribution of the rolling pressure, which increases the life of the dies when they are used on both soft and heat-treated materials. Single-face, duplex, and step type dies are available in all thread forms.71



G-E Elongation Testers for Copper Wire

General Electric Elongation Testers

Two low-stress elongation testers for measuring the stiffness, or springiness, of large and fine copper wire are recent products of the General Electric Co., Schenectady, N. Y. The large-wire tester measures the elongation of wire from 17.9 to 80.8 mils in diameter, and the portable fine-wire instrument tests wire from 3.1 to 17.9 mils in diameter.

These testers are useful for deter-

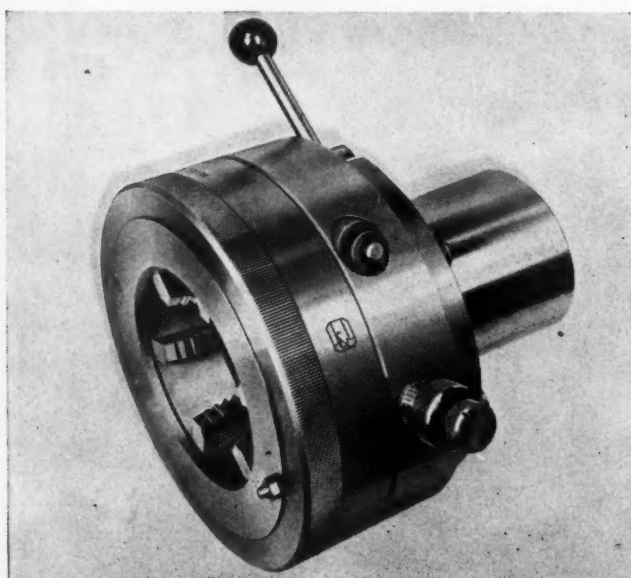


Fig. 1. Jones & Lamson High Speed Automatic Self-opening Die-head of Radial Chaser Type

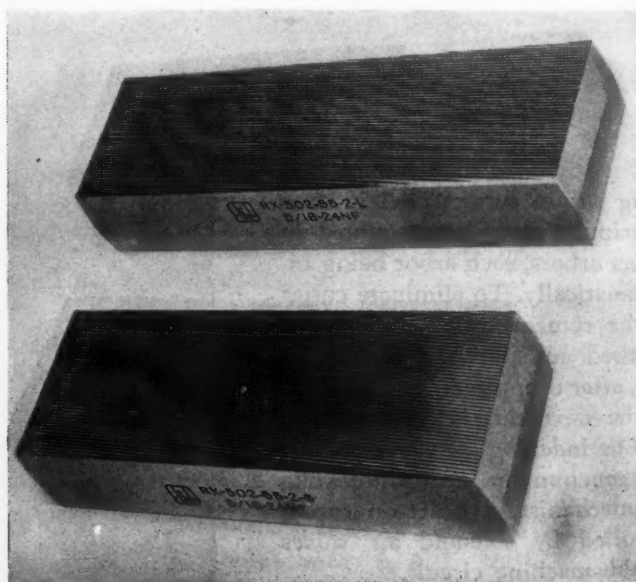


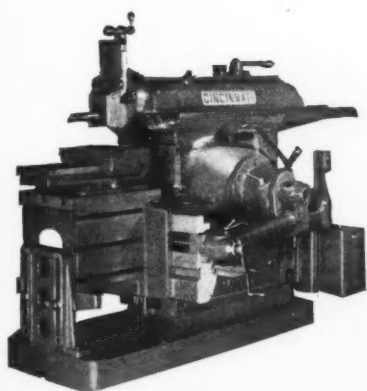
Fig. 2. Ground-thread Flat Rolling Dies Brought out by the Jones & Lamson Machine Co.

THEY LIKE IT TOUGH



*Courtesy of
Federal Engineering Co.,
Detroit, Mich.*

In the large tool and die shops of industry . . . day in and day out . . . standards are tough. The die steels are tough, and performance demands are tough.



Powerful, sturdy Cincinnati Shapers are found in these shops, for they are dependable on the tough job.

Write for Catalog N-3 for complete details on Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES



mining whether a wire possesses the degree of flexibility required for use in the manufacture of coils and other products made by winding processes, enabling wires of the same or different sizes to be compared on the basis of elongation.

In using the large-wire tester, the wire is stretched between a stationary and a movable clamp, and a unit stress of 15,000 pounds per square inch is applied by a lever arm operated by a jack-screw. Elongation is recorded on a large micrometer dial.

In using the fine-wire tester, the wire is clamped between vises located on the ends of two movable arms, and stress is applied by means of weights. Adjustments are made with dials on the face of the instrument and with the help of a small neon light which indicates whether the wire sample is under the correct stress. Stretch is indicated on a dial.....72

Multi-Diameter Turning Attachment for Lathes

Oxford Engineering, Inc., Oxford, Mich., has brought out an attachment designed to adapt any lathe or similar machine tool for handling multi-diameter turning work on a quantity production basis. This attachment, designated the "Oxford Swiss type Converter," was tested and improved during a three-year period of use in war contract work. It can be applied to any old or new standard lathe as shown in Fig. 1.

Tool movements are obtained by

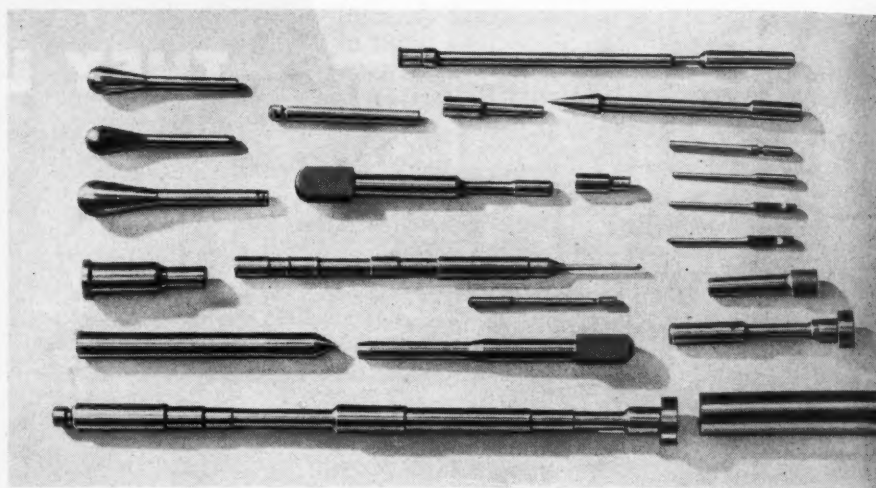


Fig. 2. Typical Multi-diameter Parts Turned Out on Quantity Production Basis with Attachment Shown in Fig. 1

means of simple cams which the user can make in his own plant. When not in use, the attachment can be easily removed and stored while the lathe is employed for other work. The attachment will produce a wide variety of parts, such as shown in Fig. 2, ranging from a needle point to 1/2

inch outside diameter and from 1/4 inch to 6 feet in length. The manufacturer states that, with this attachment, it is unnecessary to use ground stock, and that fast, accurate production can be obtained with any cold-finished stock, including stainless steel, brass, aluminum, etc.73

Gaertner Automatic Linear Dividing Machines

The Gaertner Scientific Corporation, 1201 Wrightwood Ave., Chicago 14, Ill., has added several new automatic linear dividing machines to its line of precision dividing equipment. These new machines are designed to automatically rule highly accurate linear scales of practically

any pattern or spacing having industrial or scientific applications.

The largest model will rule a continuous scale up to 40 inches in length at the rate of 60 or more lines per minute with a rated accuracy of ± 0.0001 inch. Models of lower precision and of smaller capacity are

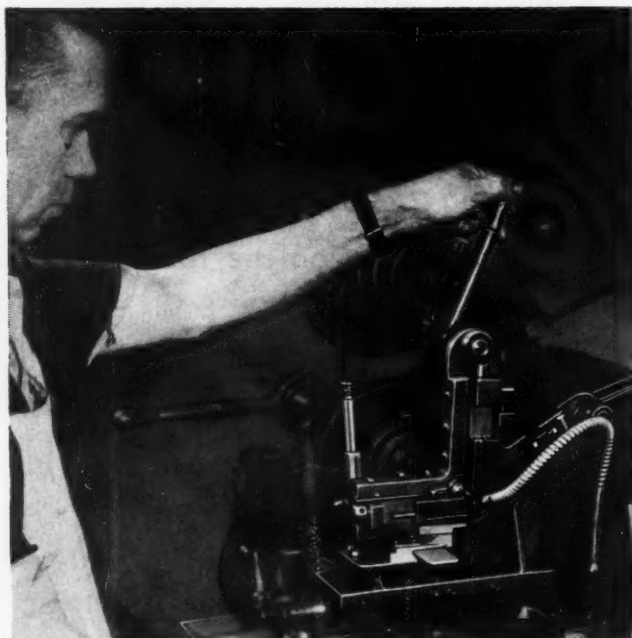
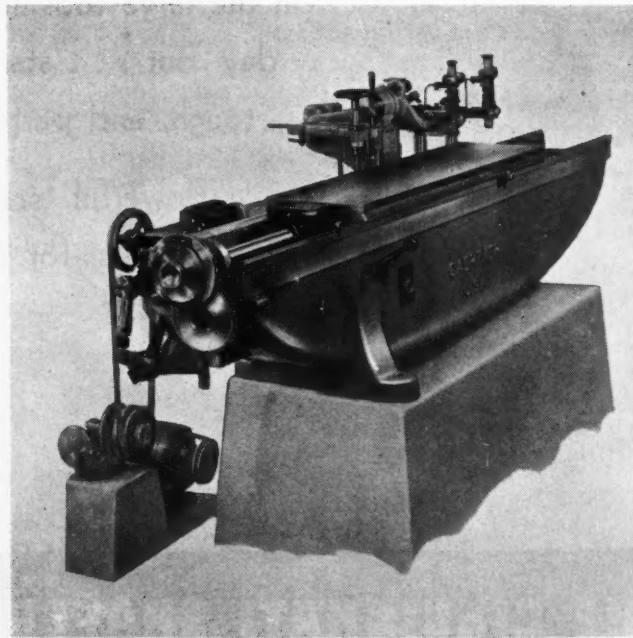
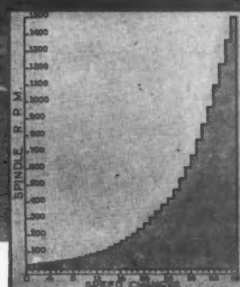
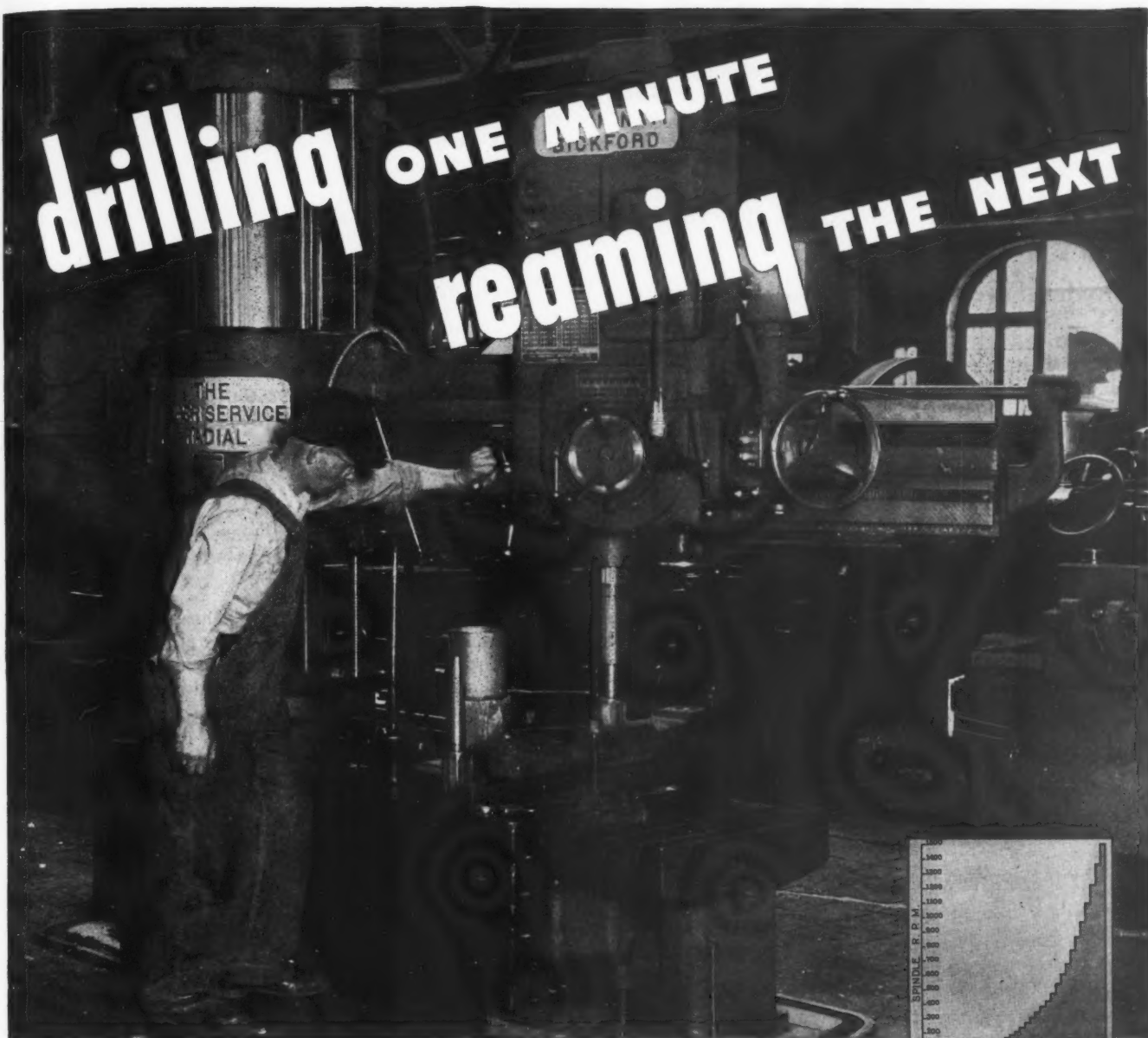


Fig. 1. Oxford Swiss Type Lathe Attachment for Turning Multi-diameter Parts



Automatic Linear Dividing Machine Brought out by the Gaertner Scientific Corporation

drilling ONE MINUTE reaming THE NEXT



On maintenance work in railroad shops Cincinnati Bickford Super Service Radials keep the iron horses fit. Boring, tapping, drilling, facing or reaming, their speed and ease of handling keep repair costs down—they have the power, and the correct speeds and feeds for every job.

FEED IN THOUSANDTHS AND THREADS PER INCH DOTTED LINE INDICATES NEUTRAL AND HAND FEED POSITION									
POSITION OF FEED CHANGE LEVER									
1	2	3	4	5	6	7	8	9	BACK GEAR LEVER
25	21	17	14	12	10	8½	7	6	→
25 F	103	87 F	71 F	59	50	42	35	29	←
1/4 T		1/4 T	1/4 T						

36 speeds—no gaps or duplication—with only 17 gears.

● 18 rates of power feeds from .006" to .125" per revolution include standard tap leads.

Write for detailed Bulletin R-24A.

See our condensed catalog in Sweet's File.



Equal Efficiency of Every Unit
Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

MACHINERY, June, 1946—211

also available. Each machine is capable of ruling any one of a large variety of line patterns with up to four different line lengths in a given pattern. Also, each machine will rule scales in either the inch or the metric system, as well as the commonly needed verniers in each system.

The operating procedure in ruling lines with these machines is com-

paratively simple. After adjusting the machine for a particular type of ruling job, the operator merely clamps the work in position and throws the starting handle. The ruling process is thereafter completely automatic, the lines of the scale produced being of whatever length, width, depth, spacing, and pattern the operator has preselected.....74

Snyder Seven-Station Machine Designed for Machining Automotive Steering Knuckles

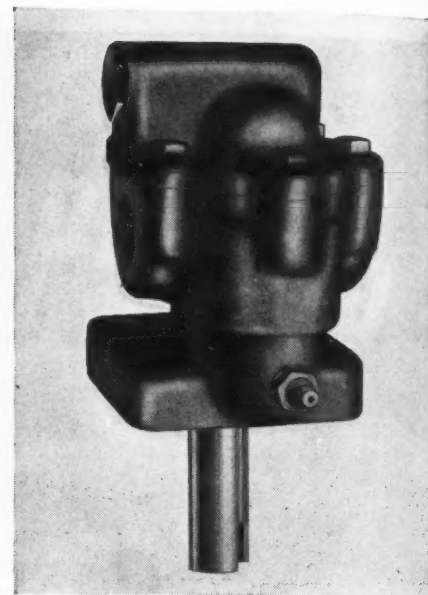
A special-purpose machine for machining steering knuckles has just been designed and built by the Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich., to obtain an estimated production of more than 200 parts an hour at an operating efficiency of 80 per cent.

Each of the seven fixtures mounted on their respective stations accommodates two parts, one part being of left-hand design and the other of right-hand design. The machining operations consist of drilling, reaming, tapping, and two-way rough- and finish-boring. These operations are performed by a series of units arranged around the automatically

operated indexing table. The automotive steering knuckles handled on this machine are of the type shown resting on the table.75

Gray-Mills Bronze Gear Pump

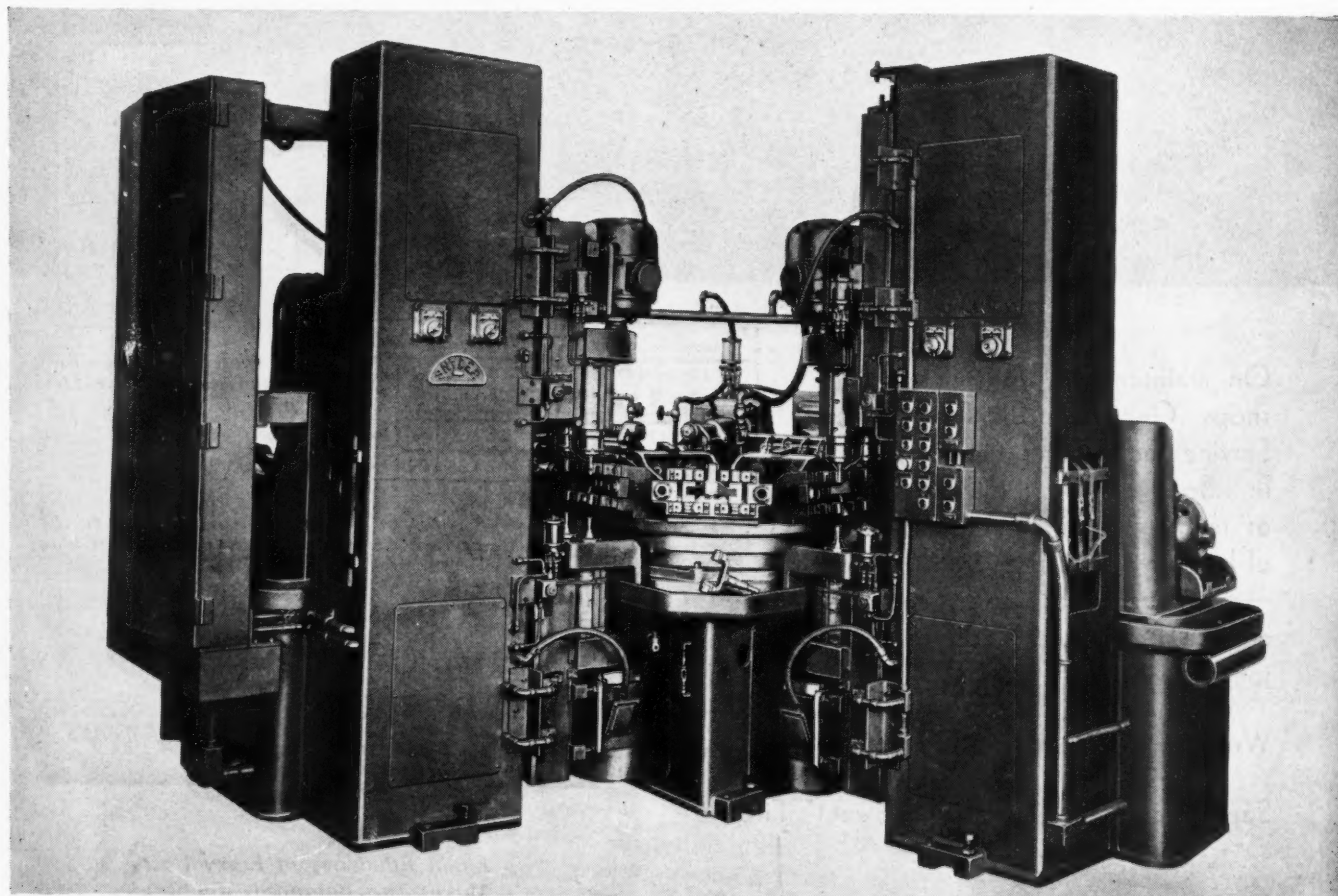
An all-bronze gear pump for use in pumping water, oils, solvents, salt solutions, chemicals, and other liquids of corrosive or non-corrosive nature which do not affect bronze has just been added to the line of pumping units and parts cleaning systems manufactured by the Gray-Mills Corporation, 1948 Ridge Ave.,



Bronze Pump Made by Gray-Mills Corporation

Evanston, Ill. These GB series pumps are machined to close tolerances.

The pumps have bronze housings and gears, stainless-steel shafts, three Oilite bearings, a built-in pressure relief valve, and an Alemite fitting for lubricating the gear-shafts.



Special Seven-station Indexing-table Machine Built by Snyder Tool & Engineering Co. for Machining Automotive Steering Knuckles

They have a maximum pressure capacity of 300 pounds per square inch; at 1750 R.P.M. the volume is 6 gallons per minute. There is a 1/2-inch discharge. The pumps can be operated by pulley or direct drive,

and can be mounted internally or externally in a variety of positions. They are available in various forms—as a pump only; a pump and motor; or a portable pump unit with motor and tank.76

Wickes Automatic Multiple Crankpin Turning Lathe

An automatic multiple crankpin turning lathe of the single-spindle type has been brought out by Wickes Brothers, Saginaw, Mich. This machine, known as the Model MP-4, is designed for either cheek-facing and rough-turning or finish-turning, spacing, and filleting all crankpins simultaneously on multiple-throw automotive type crankshafts having any number of crankpins.

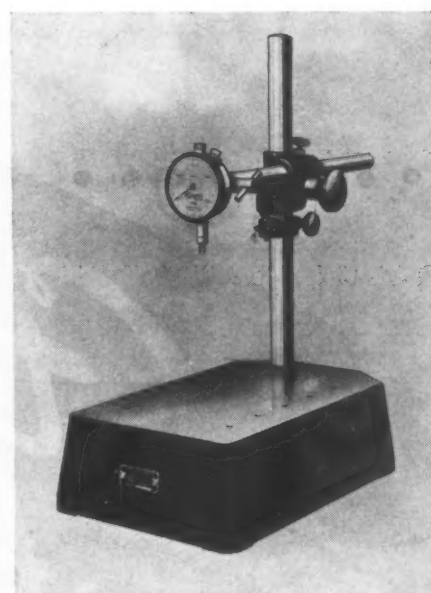
The tooling of this machine consists of roller-supported type tool-holders for each crankpin, hydraulically operated pot chucks which hold and drive the crankshaft from each end, and hydraulically operated steadyrests for supporting the crankshaft wherever necessary.

This lathe is equipped with hydraulic tool feed, and is completely automatic in operation. It is provided with cam-operated synchronized variable speed and feed mechanisms for maintaining both the lineal

cutting speed and feed per revolution at the maximum permissible rate during the entire machining cycle. The machine is also provided with a transfer switch for manual operation, which enables the operator to jog the spindle around or jog the carriage in and out for setting-up purposes. The new lathe is rigidly designed, and equipped to handle both heavy rough-turning and accurate, smooth finish-turning work.77

Dial Comparator

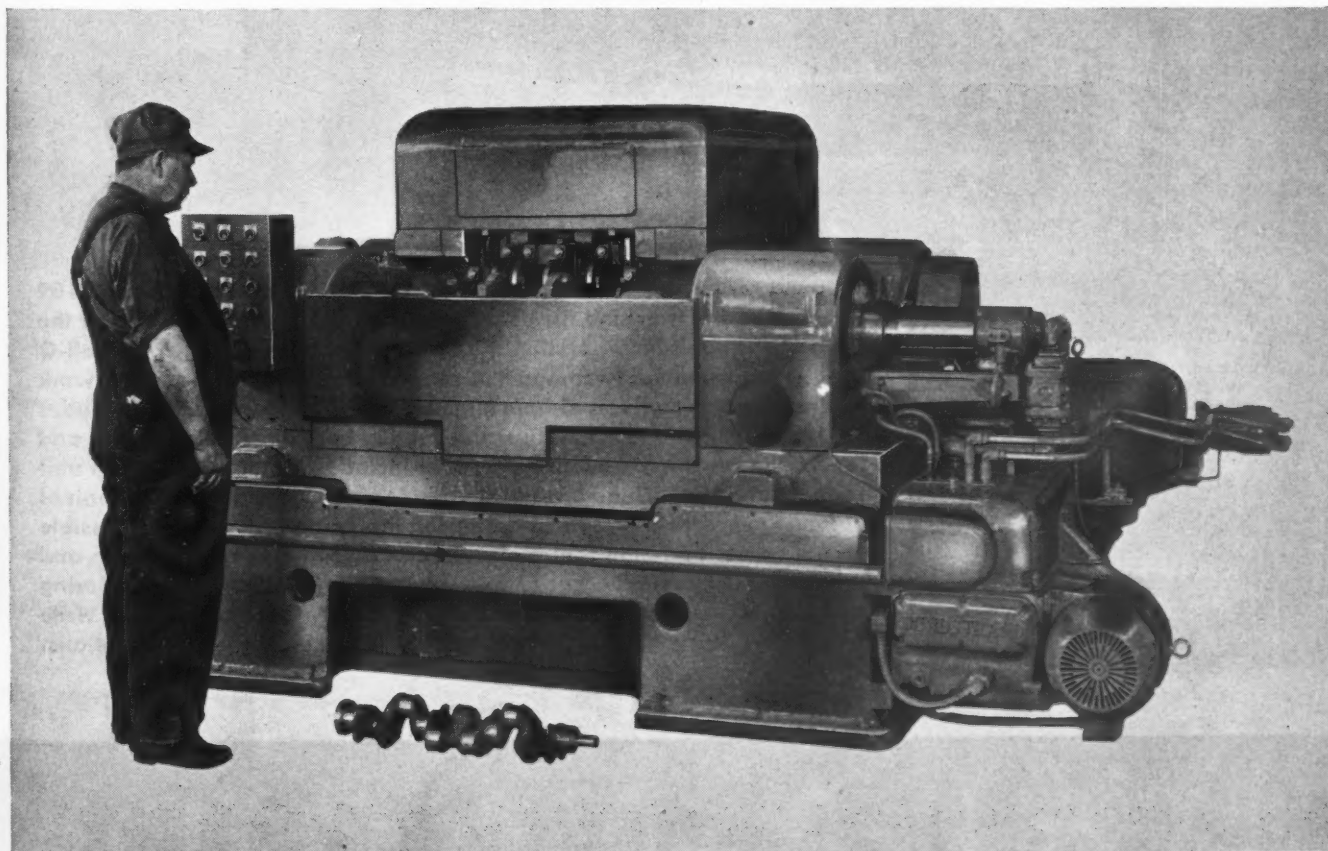
A new dial comparator has been announced by the Standard Gage Co., Poughkeepsie, N. Y., which is suited for a wide variety of uses. The versatility of this No. 107 comparator is obtained through an indicator-supporting arm, which can be easily extended, and the provision of tapped holes in the platen for use



Dial Comparator Made by the Standard Gage Co.

in fastening the work. Any dial indicator having a standard AGD lug type back can be used.

A double clamping arrangement provides means for adjusting the indicator supporting arm up or down on the vertical column and permits it to be swung to any angle in either



Automatic Multiple Crankpin Turning Lathe Brought out by Wickes Brothers

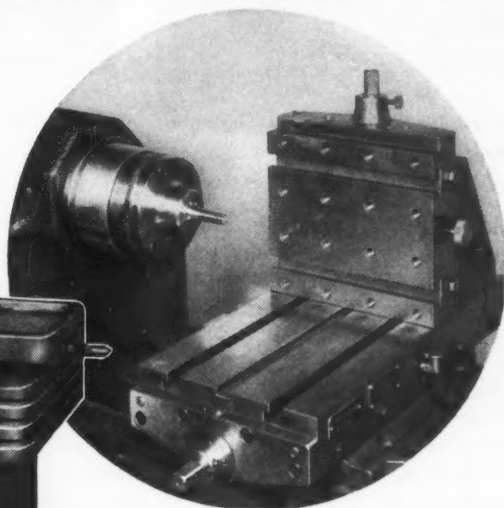


Step up
efficiency!

Designed for boring, turning, facing or chamfering, Ex-Cell-O Style 2109 Precision Boring Machine fits equally well into the production line or the toolroom. Though incorporating many of the features of larger Ex-Cell-O models, it is remarkably compact . . . especially suitable for smaller work requiring a comparatively simple machine cycle. Automatic cycle includes rapid approach and return, adjustable feed in both directions, reverse and stop. When required, coolant equipment includes a motor and pump unit mounted on the machine base and an automatic valve that synchronizes coolant flow with the start and stop of the spindle. Readily accessible machine parts and manifold hydraulic control panel make servicing and maintenance unusually easy. Ex-Cell-O Style 2109 Precision Boring Machine assures fast, economical, and highly accurate work. Write Ex-Cell-O Corporation in Detroit today for complete specifications.

EX-CELL-O SINGLE SPINDLE BORING MACHINE FOR SMALL AND MEDIUM SIZE WORK...

Below: The new Ex-Cell-O Style 2109 Precision Boring Machine shown with dwell valve, boring bar, and Ex-Cell-O Universal Fixture (extra equipment).



Above: The Ex-Cell-O Universal Fixture (extra equipment) adds flexibility to Style 2109 Precision Boring Machine. It is especially useful for short production runs and in toolroom work.

Below: View of machine with guards and cover removed. At the left is the spindle drive with step pulleys for changing speeds. The hydraulically operated spindle brake at the lower left stops the spindle when the tool is clear of the bore. The electrical compartment with door removed is also shown.



Where increased production, high accuracy, and greater economy through multiple operations are required... See EX-CELL-O First!



makes

Standard and Special Multiple Way-Type Precision Boring Machines

Multiple Drilling and other Special Purpose Machines

Precision Thread Grinding Machines

Precision Lapping Machines

Broaches and Broach Sharpening Machines

Continental Cutting Tools

Tool Grinders

Hydraulic Power Units

Grinding Spindles

Drill Jig Bushings

Drill Chip Breakers

Inspection Fixtures

Fuel Injection Equipment

R. R. Pins and Bushings

Pure-Pak Paper Milk Bottle Machines

Aircraft and Miscellaneous Production Parts

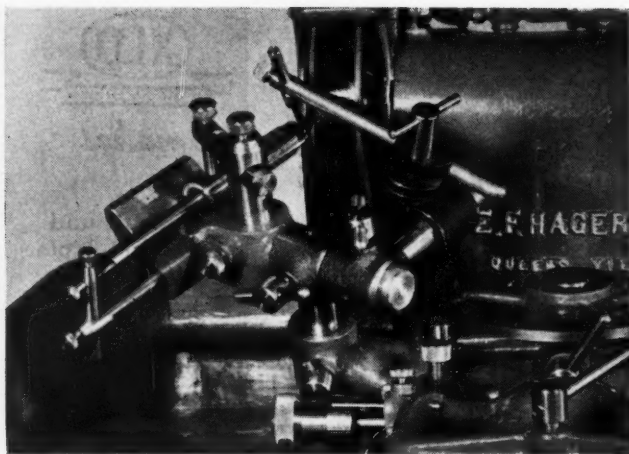


Fig. 1. Hager Carbide-tool Grinder with New Attachments Set up for Grinding Special Reamer

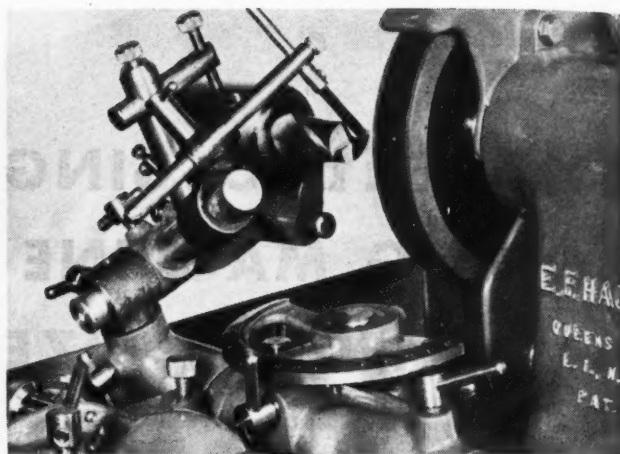


Fig. 2. Set-up Using New Hager Attachments on Carbide-tool Grinder for Sharpening End-mill

the horizontal or vertical plane. With this arrangement, it is possible to locate the indicator at any desired distance from the column. Accurate setting of the indicator is facilitated by a vernier screw. A friction washer, concealed in the swivel joint, prevents the indicator arm from being dropped unintentionally when the clamp is loosened for adjusting.

The working area of the platen is 6 by 9 inches. There are five tapped holes on each side of the platen, spaced 1 1/2 inches apart and tapped to receive 1/4-20 bolts for securing the piece or work to be checked.....78

operation and guesswork and also saves wear on the diamond wheels.

Fig. 2 shows another set-up, in which eight of the new attachments

are employed. In this case, a two-fluted spiral end-mill with a No. 30 milling machine taper is set up for grinding the spiral cutting edge...79

Ram Type Turret for Axelson Lathe

The Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 11, Calif., has just brought out a heavy-duty ram type turret to fit its standard 20-inch lathe. This attachment is available with hand feed only or with full power feeds. Lead-screw threading is also available with the power feed. An automatic reverse clutch

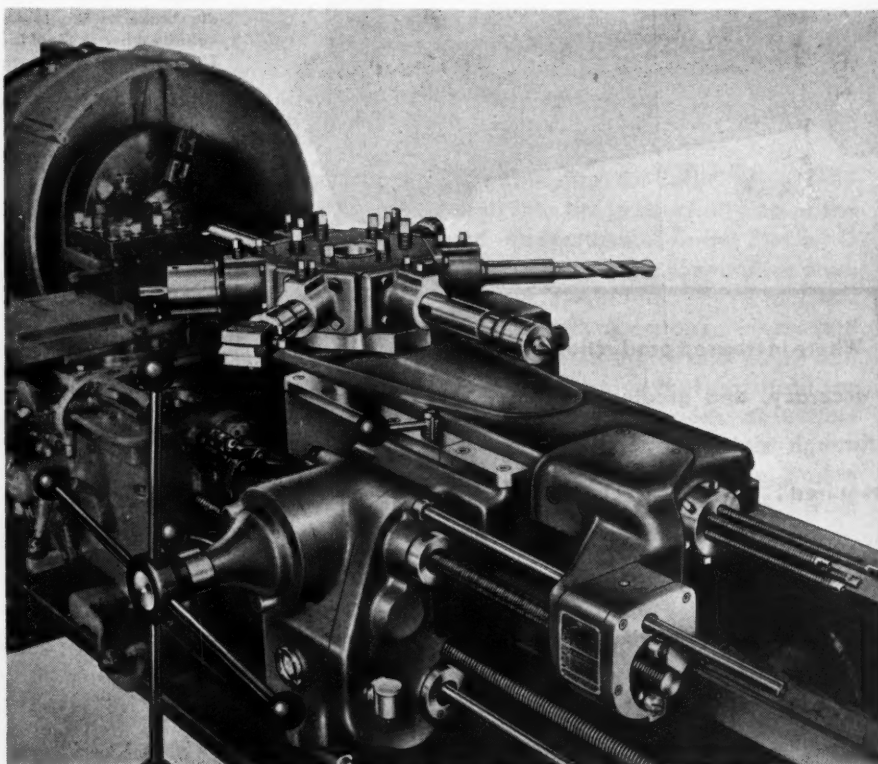
in the apron causes it to feed in the right direction, regardless of the direction of feed-rod rotation.

The six-station turret rotates on tapered roller bearings, and is automatically indexed and clamped. The distance across the hexagonal turret is 11 inches. The fifty-four ram feeds are the same as for the turret,

New Line of Attachments for Hager Carbide-Tool Grinder

A complete line of specially designed attachments that extend the range of the Hager carbide-tool grinder to the grinding of milling cutters, counterbores, inserted-tooth face mills, spiral reamers, end-mills, and many other special types of carbide-tipped tools, has been developed by E. F. Hager & Son, 98-02 217th Lane, Queens Village 9, N. Y. These attachments, designed for flexible and simple set-ups, assure fixed control of the tools throughout the grinding operation and enable the operator to work out innumerable arrangements to suit his individual requirements. All free-hand grinding is eliminated, and a keen straight cutting face is readily obtained.

In Fig. 1 is shown a typical set-up on a Hager tool grinder in which five of the twenty new attachments available are employed. This set-up is being used to grind the 45-degree angle on a four-blade, special type reamer. Fixed control of the tool during grinding eliminates free-hand



Ram Type Turret for Axelson Lathe

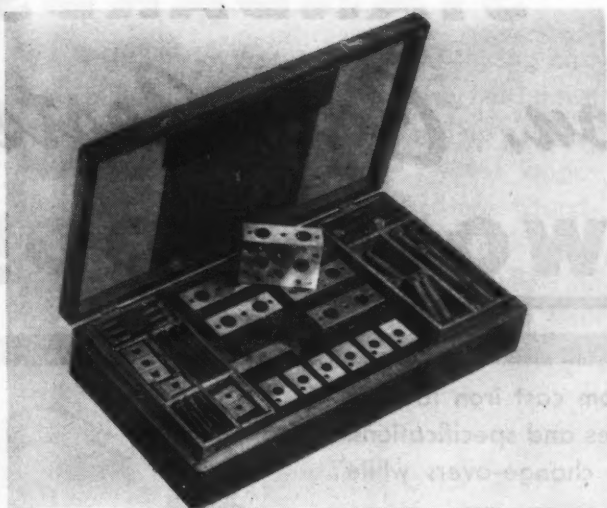


Fig. 1. Moore Parallel Set-up Blocks in Mahogany Box

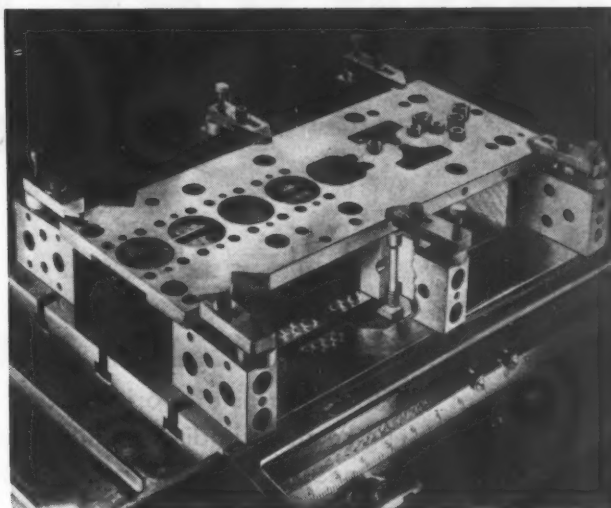


Fig. 2. Typical Work Set-up Using Moore Blocks

and range from 0.003 to 0.185 inch. The maximum length of cut is 14 inches.

An outstanding feature of this turret is the lead-screw threading attachment which is driven directly from the apron gearing and has interchangeable lead-screws and nuts which can be changed quickly with a minimum of tools and without disassembling any part of the mechanism. Opening of the half-nuts can be accomplished by hand or by the same indexing stop mechanism that releases the feeds. The apron reversing clutch makes it possible to cut either right- or left-hand threads of the same lead with the same right-hand leader and nuts by reversing the lathe spindles. 80

Moore Set-Up Blocks

A set of parallel set-up blocks that can be built up to twelve different heights has been developed by the Moore Special Tool Co., Inc., 734 Union Ave., Bridgeport 7, Conn. This complete set of blocks consists of six groups of two sizes, 1 by 2 by 3 inches and 7/8 by 1 1/4 by 1 1/2 inches, packed in a mahogany box as shown in Fig. 1. Each block can be used in any of its three dimension positions. Originally designed for precision work in the Moore jig borer and jig grinder, these blocks are equally adaptable for large or small work in the tool-room, on production jobs, or for inspection purposes.

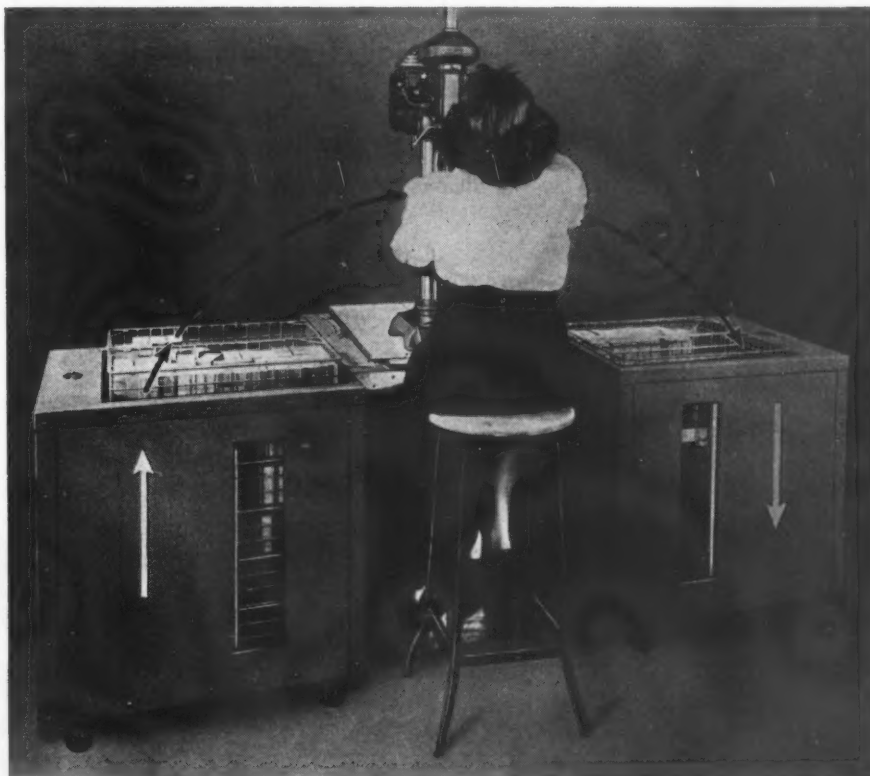
The blocks are drilled and counter-bored for bolting to the machine table or faceplate, and will not slide off the machine when attaching work to a vertical surface, such as a micro-sine plate, a rotary table used for radial spacing, or a lathe faceplate.

Tapped holes on all three sides provide for supplementary straps and permit the work to be supported either parallel or perpendicular to the working surfaces. These blocks can be employed as angle-irons or they can be substituted for gage-blocks if dimensional accuracy requirements are not too exacting.

While not so accurate as gage-blocks, they can be used more conveniently for some purposes. The blocks are manufactured from carburized chrome-nickel steel to obtain a tough core and hard surface (60-62 Rockwell C). They are finish-ground to limits of ± 0.0002 and -0.0000 inch. 81

Portable Automatic Material-Handling Racks

A three-in-one unit that combines automatic material-handling with storage and transportation service is now being manufactured by the American Machine & Foundry Co., 511 Fifth Ave., New York 17, N. Y.



Automatic Material-handling Racks Made by American Machine & Foundry Co.

CARBOLOY "STANDARDS"

(TRADEMARK)

CEMENTED CARBIDE

Speed Production. Cut Costs

ON JOB LOT WORK TOO!

Job lot machining at Oakland Machine Works* jumps from cast iron to steel to aluminum automotive engine parts in diversified quantities and specifications. That means a problem to meet in frequent, fast, tooling change-overs while keeping tool costs low—production on schedule.

By basing tool design, wherever possible, on Standard Tools, quickly ground to fit the job, and by using Standard Blanks to make and repair the necessary range of special tools in their own Tool Department, this job lot shop makes change-overs—meets unforeseen production demands—without costly delays or tool costs.

Since most tools are Standards, or "specials" requiring only Standard Blanks modified to fit, they get:

1. Maximum economy—Standard Tools and Blanks are mass produced for lowest cost.
2. Adaptability to 60-80% of all their carbide needs—Standard Tools and Blanks are quickly ground to shape.
3. Fast replacement—Standard Tools and Blanks are stocked in 58 cities, coast-to-coast.

These are the answers to diversified, exacting production schedules. These are the qualities which have "sold" Oakland Machine Works on Standard Carboly Tools and Blanks.

Oakland Machine Works regularly uses 3 of these Standard Carboly Tool styles.



*Royal Oak, Michigan

CARBOLOY COMPANY, INC.

11147 E. 8 MILE AVENUE, DETROIT 32, MICHIGAN

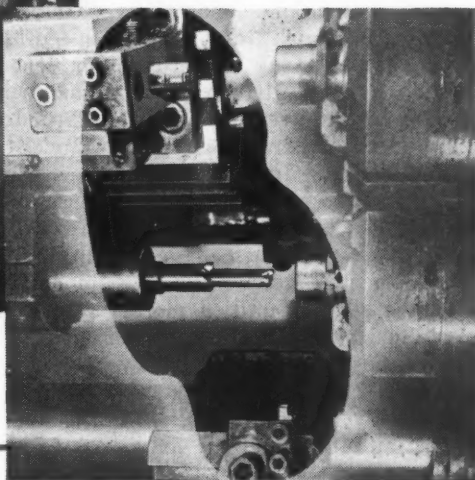
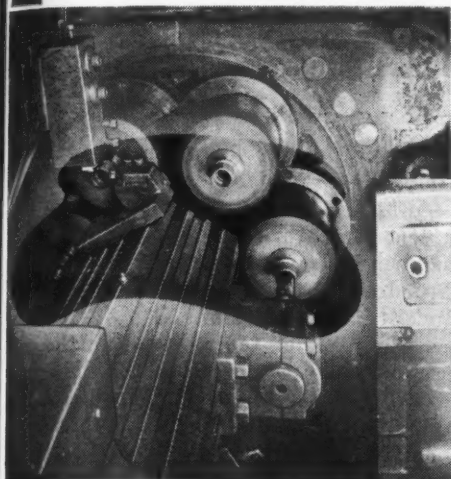
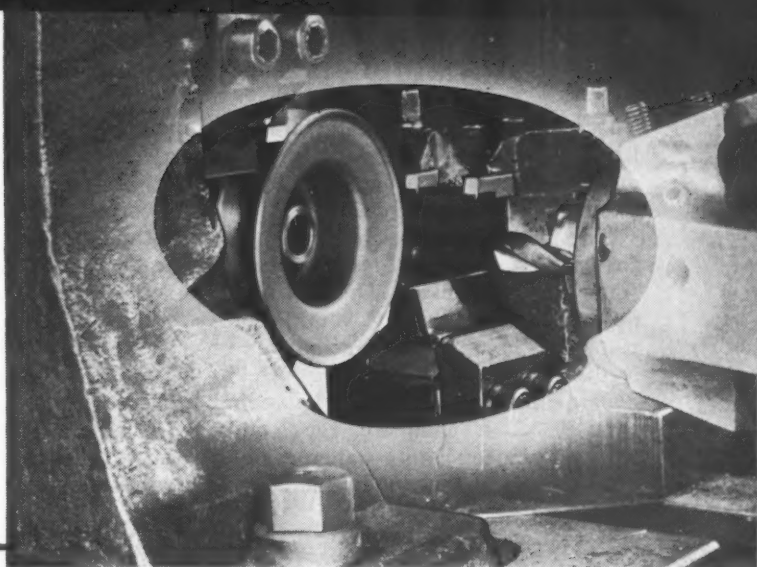
CARBOLOY

(TRADEMARK) CEMENTED CARBIDE

CHICAGO • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON, CONN.

EXTRA DIVIDENDS FROM "STANDARDS"

On **this** job-lot application—machining cast iron pulleys—"Standards" not only held down **initial** tool costs but also stepped up production; kept machines running 4 times longer per tool grind. For maximum savings, Standard Carboloy Tools were adapted to 8 roughing and finishing operations; while all "specials," except drill, were tipped with "Standard" Carboloy Blanks.

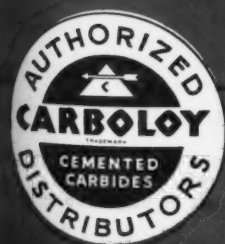
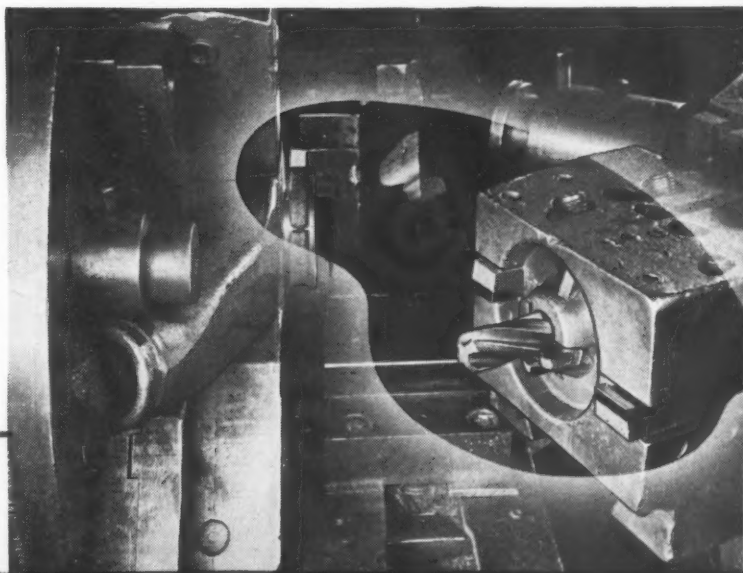


QUICK CHANGES AT MINIMUM COST

On job-lot work, set-ups change frequently. "Today" the job is a carbide-tipped 11-tool set-up for cast iron water pump housing parts. "Tomorrow" it may be an entirely different 27-tool set-up for one-piece aluminum fans and pulleys. By carefully planned use of adaptable "Standard" Carboloy Tools, Oakland keep tool cost down despite frequent changes.

MACHINING CAST IRON HOUSINGS AT 340 F.P.M.

When carbide tools went on this job—machining cast iron water pump housings—speeds jumped to 340 F.P.M.; tool life stepped up 600%. For extra economy, the 7 tools shown were made with "Standard" Carboloy Blanks, available from stock at low cost.



STOCKED AND SOLD BY LEADING MILL SUPPLY
DISTRIBUTORS IN 58 CITIES COAST TO COAST

These new automatic material-handling racks have been specially developed to speed up production by reducing operator fatigue.

The parts may be placed in the tote boxes or directly on the platform of the racks. The units are designed to handle any weight, compensation being made for changes in loading by merely hooking or unhooking the ends of counterbalancing springs. The complete rack units are mounted on ball-bearing casters.

The operator shown in the accom-

panying illustration can, with scarcely any effort and without bending or lifting, remove the material to be processed from the automatic rack at the left and just as easily place the processed material in the rack at the right. As the trays in the rack are emptied, they automatically rise to the working level, while the trays at the right are automatically lowered into the rack when they become filled. The filled racks can be easily rolled away and used as storage units.82



Regular Model "Grip-Slide"
Threading and Tapping Tool

John S. Barnes Fluid Power Units

The John S. Barnes Corporation, 325 S. Water St., Rockford, Ill., has brought out two new hydraulic units designed to provide smooth, flexible sources of fluid power. The F-10-A unit, shown in Fig. 1, is intended for light-duty applications, and can be mounted in the machine or on a separate base. Piping connections to the cylinder or auxiliary control valves of the machine served by the unit complete the installation. The unit is furnished with gear pump, overload valve, motor coupling, pressure gage, and miscellaneous parts, but without the motor. A motor furnished by the manufacturer at additional cost or a motor supplied by the user can be mounted on the unit.

This unit has an oil capacity of 9 gallons and a maximum pump delivery of 5 gallons per minute; it provides a maximum gage pressure of 500 pounds per square inch. The

weight of the unit is approximately 275 pounds.

The F-20-A hydraulic unit, shown in Fig. 2, is designed to handle a wide range of machine operations which require units of 2 and 5 H.P. This unit employs a Roto-Blade pump, which is direct-driven by the motor. The output pressure is limited by a Barnes hydraulically balanced relief valve. In addition to the tank pump and relief valve, the unit also includes the motor coupling, pressure gage, and miscellaneous parts, but does not include the motor. Like the smaller unit, a motor can be installed by the manufacturer at additional cost. The oil capacity of this unit is 27 gallons, the maximum pump delivery capacity 12 1/2 gallons per minute, and the maximum gage pressure 1000 pounds per square inch. This unit weighs 675 pounds. 83

"Grip-Slide" Threading and Tapping Tool

A precision tool known as the "Grip-Slide," which is designed to speed-up external or internal, right- or left-hand threading on a lathe, has been placed on the market by the Threadmiller Corporation, 17 E. 42nd St., New York 17, N. Y. This new "Grip-Slide" tool is made in the regular model, as shown in the illustration, for use on bench and small engine lathes, and in a "Giant" model for larger engine lathes. The regular model tool has a capacity for cutting threads ranging in size from 2-56 to 5/8 inch in steel, for lengths up to 3 1/2 inches, and for tapping threads in sizes ranging from 2-56 to 5/16 inch in steel with two- or three-flute spiral taps.

The "Giant" model tool has a capacity for cutting threads from 10-

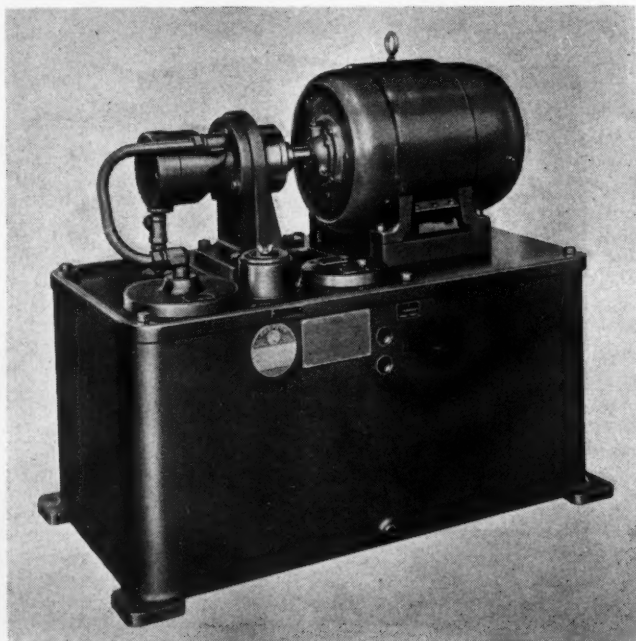


Fig. 1. Barnes New F-10-A Hydraulic Unit

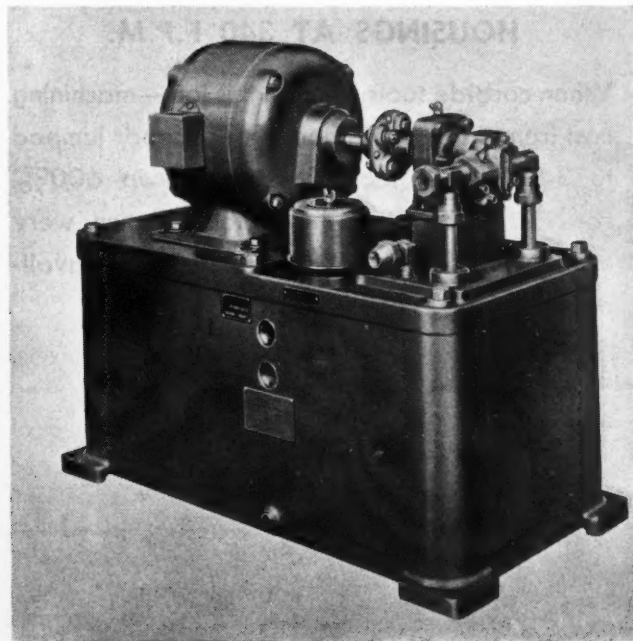


Fig. 2. Barnes F-20-A Hydraulic Unit

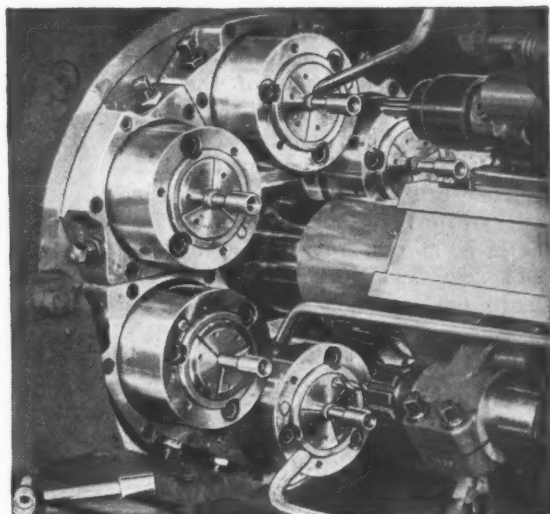
LEADERSHIP BASED ON ACCOMPLISHED FACTS



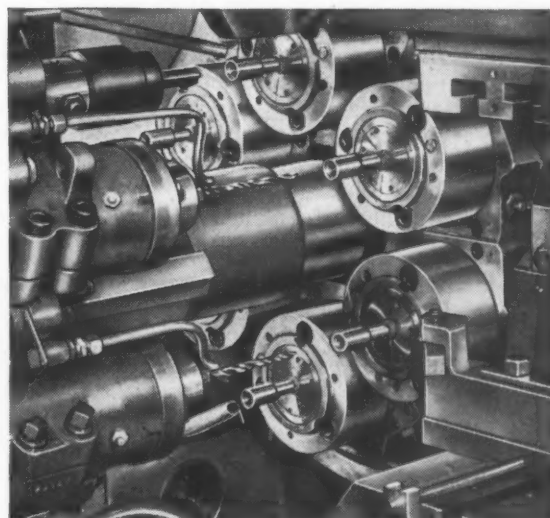
This will interest you if your work involves small accurate parts. In tooling and equipping our Model 65 Six Spindle Automatic Chucking Machines for the requirements of the Moeller Instrument Company, Richmond Hill, New York, provision was made for handling a variety of sizes of similar parts in various metals including steel, nickel copper alloy, and naval brass forgings.

The piece illustrated is a $3\frac{1}{2}$ " long tapered steel part, $\frac{3}{4}$ " diameter on the large end, calling for drilling to a depth of $3\frac{1}{2}$ ". It is held by specially designed collets, each with an extra long bearing, for drilling a deep hole leaving a thin wall. Six operations are performed at a gross production rate of 187 pieces per hour. Not a dramatically difficult assignment but a good illustration of the adaptability of New Britains to a wide range of applications . . . and another instance of high production at low cost per piece.

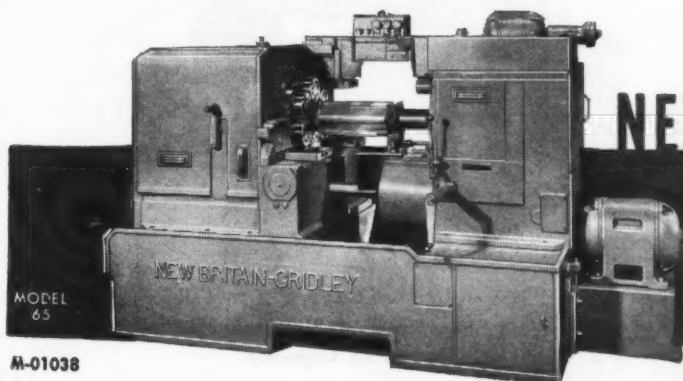
Many do not realize the wide range of practical applications for multiple spindle automatic screw and chucking machines. Our sales engineers do, and offer you a competent engineering service you may profit by investigating.



FRONT VIEW — New Britains are built to allow easy accessibility for simplified chucking, cutting tool and attachment setup.



REAR VIEW — New Britain construction provides extra large chip space . . . lots of room from all sides giving excellent visibility and easy tool adjustment.



NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY

NEW BRITAIN, CONNECTICUT

New Britain-Gridley Machine Division

32 to 3/4 inch in steel for thread lengths up to 5 1/2 inches, and for tapping threads in sizes ranging from 10-32 to 5/8-11 with a two- or three-flute spiral tap.

For either internal or external threading, the proper die or tap is simply inserted in the tool-holder, and the knurled sleeve of the tool grasped and slid toward the work. When the desired length of thread has been cut, as shown by the 1/4-inch calibrations on the guide bar, the grip on the tool is released and the lathe spindle reversed. The tool is backed off by grasping the knurled sleeve again. 84

Centerless Lapping Machine

A Model 100 centerless lapping machine of an entirely new design, which eliminates the need for set-ups or auxiliary tools, has just been announced by the Size Control Co., Division of American Machine & Gage Co., 4636 W. Fulton St., Chicago 44, Ill. It is claimed that the precision-lapping of cylindrical pieces to a finish of less than 2 micro-inches is easily accomplished on this machine at a rapid rate. One piece or 100 pieces can be easily lapped without requiring any set-ups or the use of ring laps or other tools such as are customarily required for lapping operations.

This machine is furnished with a

set of lapping rolls ground for precision work, a vibrationless drive, a 1/2-H.P. 110-volt alternating-current motor, a set of three lapping sticks, a jar of lapping compound, and complete instructions for operation.....85

Dumore Flexible-Shaft Utility Tool

A portable flexible-shaft utility tool designed especially for use in corners and places not readily reached by regular tools is being manufactured by the Dumore Co., Racine, Wis. This tool, weighing only 8 pounds, has a 1/15-H.P. motor, which can be suspended from any convenient hook and made ready for use by simply connecting it with an electrical circuit outlet.

The flexible shaft is 36 1/2 inches long, and has a normal hand-piece speed of 500 to 3000 R.P.M. at the gear reduction end. If desired, power can be taken off the other end of the motor to obtain direct drive speeds



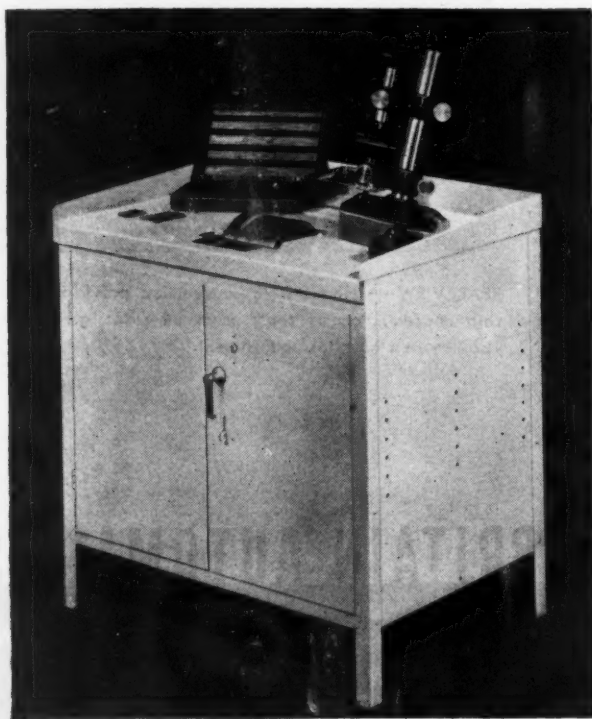
Flexible-shaft Utility Tool Made by the Dumore Co.

of from 3000 to 10,000 R.P.M., the speed being controlled by a foot-operated rheostat. The No. 0 balanced Jacobs chuck will take all drills, grinding wheels, buffers, and countersink bits with shanks up to 1/8 inch in diameter.86

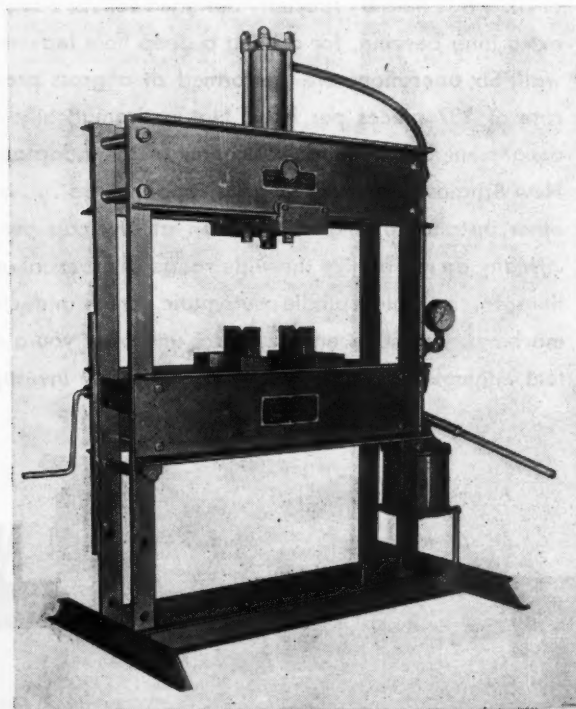
Rodgers Sixty-Ton Shop Press

A new press known as the Rodgers "Sixty" has been placed on the market by Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, Minn. This press has been designed to obtain fast operation, ruggedness, and versatility. It is adapted for per-

forming such operations as pressing, straightening, shearing, bending, clamping, riveting, broaching, and assembling. A machined and matched pair of V-blocks is furnished as standard equipment. Special attachments for ring-gear riveting and for



Precision Centerless Lapping Machine Built by Size Control Co.



Rodgers Shop Press of Sixty-ton Maximum Operating Capacity

HOW TO MACHINE DEEP GROOVES on a STANDARD **GISHOLT** TURRET LATHE

Here's an interesting example of extremely heavy machining done on a standard Gisholt 4L Saddle Type Turret Lathe. It indicates how many a job may be handled with equipment already on the floor and without changes in the base design of the machine.

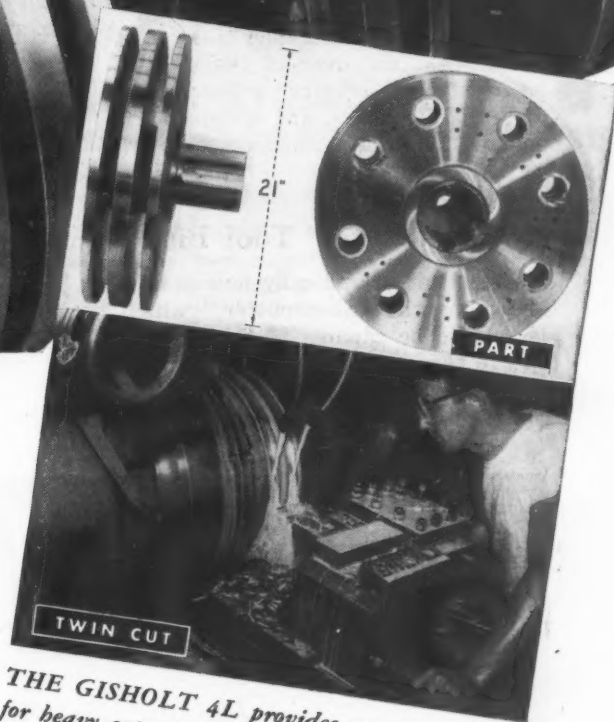
Heat-treated steel forgings for 21" diameter vibration dampeners for Diesel engines were machined from the solid, with simultaneous cutting of two grooves $7\frac{1}{4}$ " deep by $5/16$ " wide. The only special attachment required on the Gisholt was an auxiliary tool holder and base to hold the grooving tools. Roughing and finishing cuts were taken, holding to close tolerances for size and squareness, in a total cutting time of one hour and 29 minutes.

For those interested in complete details, some reprints of an article on this unusual job have been made available. Write for your copy.

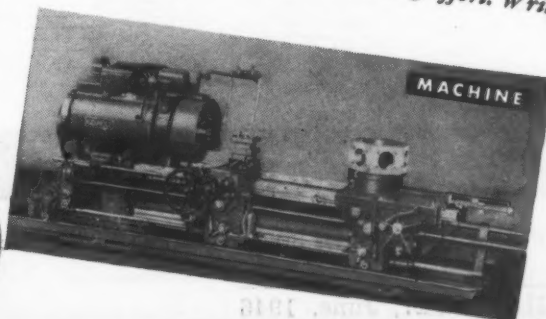
GISHOLT MACHINE COMPANY

1009 East Washington Ave. • Madison 3, Wis.

Look Ahead . . . Keep Ahead . . . With
Gisholt Improvements in Metal Turning



THE GISHOLT 4L provides extreme rigidity for heavy cuts with bed and headstock cast integrally and thick block-type ways of hardened steel which support all bearing surfaces for heavy carriages. This large and powerful machine requires surprisingly light operating effort. Write for literature.



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

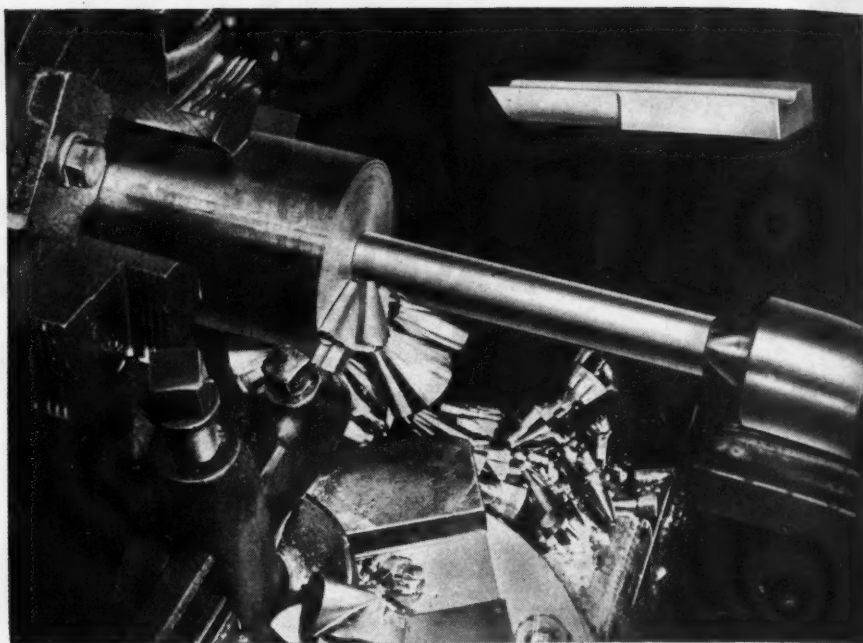
aligning and centering shafts, rods, etc., as well as an end support stand which is adjustable for handling long material, are also available.

Power is supplied by a Rodgers two-speed hydraulic hand pump which moves the ram, at high speed, 2 1/2 inches per pump stroke at pressures up to 2000 pounds. The operating lever on the pump can be quickly changed to the high-pressure operating position for obtaining pressures up to 60 tons.

The hydraulic operating cylinder rests on rollers that ride on the flanges of the upper bolster and can be moved across the entire working width of the press. The long cylinder provides a ram travel of 13 inches in one continuous stroke. Flexibility is achieved by adjusting the lower bolster through a hand-crank. The maximum opening between bolsters is 38 inches, and the minimum opening 8 inches. A special model with an opening range of 8 to 48 inches is available. The working space between the sides is 45 inches, but longer pieces can be handled through the open sides. The press has an over-all height of 88 3/4 inches, requires a floor space of 38 by 70 inches, and weighs 1125 pounds. 87

"Shearcutter" Tool Bit

A tool bit of radically new design known as the "Shearcutter," which is said to be capable of taking cuts two to three times the size normally possible with conventional tools of comparable size, has been announced



"Shearcutter" Tool Bit Brought out by Fearless Tool Co.

by the Fearless Tool Co., 1234 S. Gramercy Place, Los Angeles 6, Calif. This new tool, made in standard sizes, embodies a scientifically pre-shaped cutting edge and chip pressure channel which is claimed to assure a true shear-cutting action.

Digging in and chattering of the tool is said to be prevented by the unique manner in which the chip is

utilized to improve the cutting action and to keep the cutting edge sharp. The illustration shows a 3/8-inch Shearcutter taking a cut 1 1/8 inches wide in cold-rolled steel.

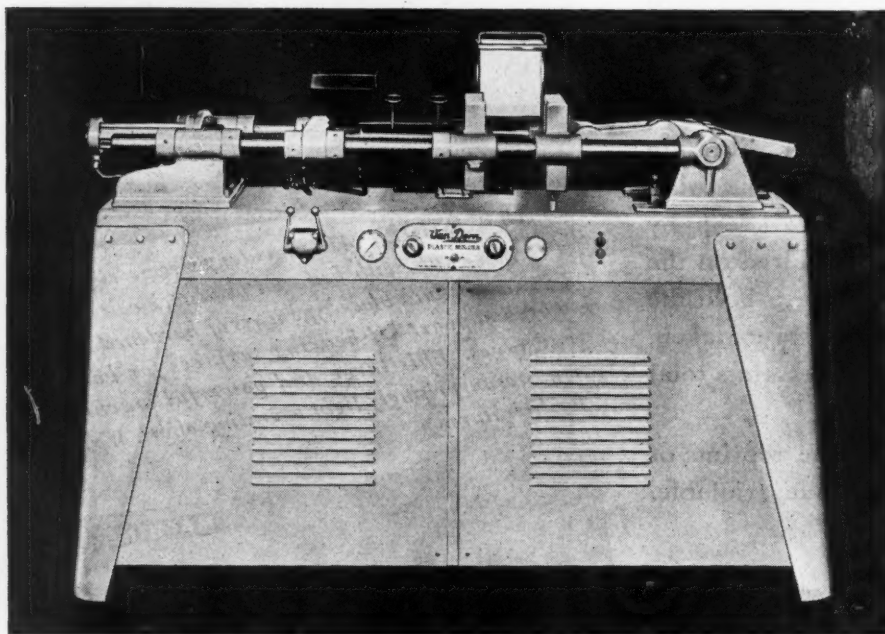
This cutting tool can be used on copper, brass, bronze, plastics, cast iron, steel and other ferrous and non-ferrous alloys without changing the original form.88

Van Dorn Plastics Injection Press

A power-operated plastics injection press of 1-ounce capacity has just been placed on the market by

the Van Dorn Iron Works Co., 2685 E. 79th St., Cleveland 4, Ohio. This Model H-200 injection press was designed to meet the demand for a simplified, easily operated molding machine adapted for performing the wide range of molding operations encountered in production, research, and instruction work. Lower costs for molds, reduced set-up time, and adequate production speeds are claimed for the new machine.

Plunger-injection and mold-closing operations are performed by hydraulic cylinders. The gear type pump is driven by a 2-H.P. electric motor which develops line pressures up to 1500 pounds. Automatic injection of parts is accomplished by a simple knock-out ejector pin arrangement. This eliminates the handling of molds and helps to speed up the removal of finished parts. Automatic temperature control is provided by heating bands arranged in two zones. The temperature in each zone is maintained by an individual thermostat within plus or minus 6 degrees F. The range of the thermostats is from 100 to 500 degrees F.

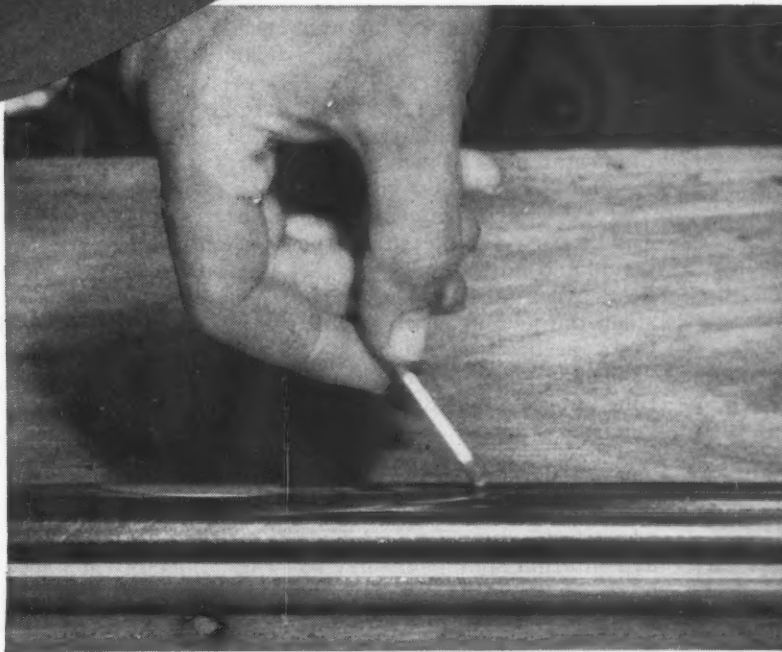


Plastics Molding Press Brought out by the Van Dorn Iron Works Co.

What This Simple Test Shows You About SUPERFINISH



Take a ground shaft (finish ground if you like) and scratch a match on it. The match will light. Why? Because there is enough surface roughness to abrade the sulphur tip—to cause friction and heat. These same ridges can penetrate an oil film and cause friction on bearing surfaces. Surface roughness is 20 micro-inches, R.M.S.



Make the same test on a Superfinished surface. The match won't ignite. There is nothing to create friction. Here is a degree of smoothness that will support and maintain a uniformly thin oil film—without ridges to penetrate and abrade the mating surface. The life of such a bearing surface is unlimited. Surface Superfinished to 3 micro-inches, R.M.S.

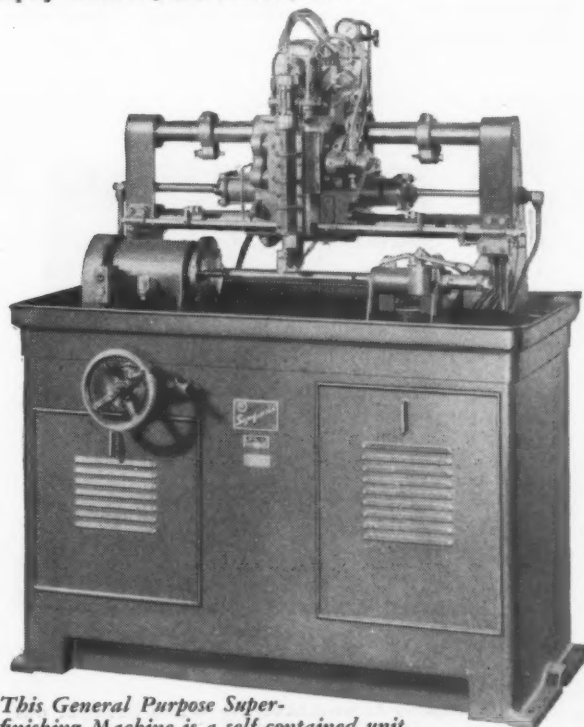
Removing grinder scratches, feed spirals, chatter marks, and partially loosened metal splinters by Superfinishing is a very quick and inexpensive operation. These finely finished surfaces are a real economy because they not only reduce friction and wear to a new minimum, but they also eliminate the most common bearing troubles. And surprisingly enough, Superfinishing may actually cut your manufacturing costs as well—by eliminating other more expensive processes involved in producing smooth finish.

Gisholt engineers are ready to give you facts about this important development.

GISHOLT MACHINE COMPANY

1209 East Washington Avenue
Madison 3, Wisconsin

**Look Ahead
Keep Ahead
with Gisholt**



This General Purpose Superfinishing Machine is a self-contained unit, simple to operate and ideally suited to handle a wide range of miscellaneous or production work. Other sizes and types are available, as well as Superfinishing attachments for lathes.

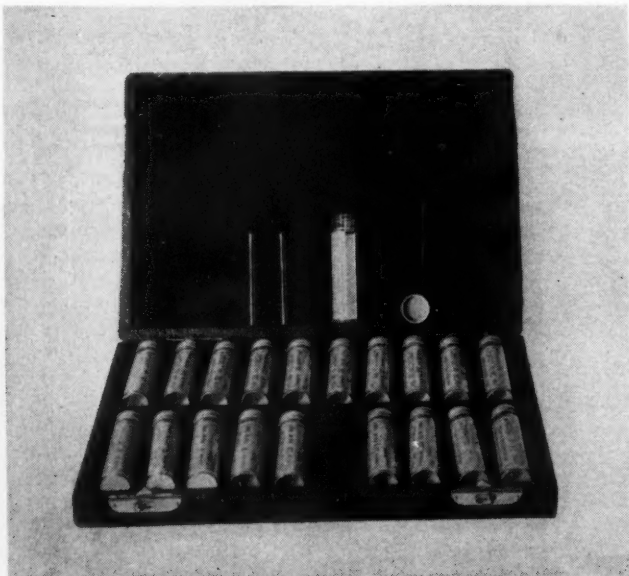
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

The minimum mold thickness is 3 inches, and the maximum thickness 8 1/2 inches. The platen is 8 by 8 inches, and the mold opening 6 inches. The 1-ounce injection capacity can be used for producing either single parts or multiple parts having a total weight of one ounce.....89

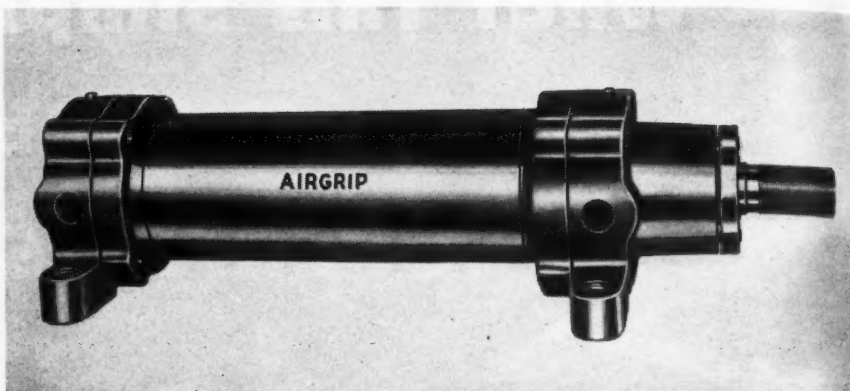
Van Keuren Carbology Gear-Measuring Wires

The Van Keuren Co., 178 Waltham St., Watertown, Mass., has announced a new set of No. 20-1.68 C Carbology gear-measuring wires. The set, including two wires for each size, covers a range of from 7 to 80 diametral pitch, the wire diameters ranging from 0.240 to 0.021 inch. The 1.68 Carbology gear wire series can be used for measuring both external and internal gears. Since Carbology wears fifty times longer than steel, the new gear wires will retain their accuracy of plus or minus 0.000025 inch for a long period of time, and will not develop flat spots, gouges, or nicks.

Accurate gear tables are furnished with every set of VK gear wires which give the measurements over wires for 1 diametral pitch external and internal spur gears having from 5 to 500 teeth, and for pressure angles of 14 1/2, 17 1/2, 20, 25, and 30 degrees. The only calculation required is to divide the table values by the diametral pitch of the gear being measured. An additional table shows the amount the teeth are too thick or too thin when the measurement over the wires is greater or less than standard.90



Carbology Gear-measuring Wires Brought out by the Van Keuren Co.



Hydraulic Cylinder of Non-rotating Type Made by the Anker-Holth Mfg. Co.

Anker-Holth Non-Rotating Hydraulic Cylinders

In addition to its regular line of air cylinders, the Anker-Holth Mfg. Co., 2727 Connors St., Port Huron, Mich., is now building a new line of non-rotating hydraulic cylinders which includes eleven sizes and seven standard mountings. Among the outstanding features of the new line are absence of tie-rods; cushioned cylinders with no increase in length; two-way action; simple design of sturdy construction; one-piece, step-seal piston-rings; standard mountings in each pressure range; operation by either oil or water service; and a safety factor of 6 to 1.

Cylinders are available for low pressures up to 750 pounds per square inch, and for high pressures from 750 to 2000 pounds per square inch, in sizes having bore diameters ranging from 1 1/2 to 8 inches. These sizes are regularly made with mountings of the foot, trunnion,

center-line, clevis, flange (rod end), flange (blind end), and adapter types. A standard, over-size, or double-end rod can be furnished for any length stroke. 91

Thor Pneumatic Impact Wrench

A pneumatically operated wrench of the impact type for driving and removing nuts, bolts, and cap-screws in sizes up to 3/8 inch has just been announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill. This wrench, which is only 5 7/8 inches long and weighs 3 3/4 pounds, is said to be the smallest and lightest of its class to be developed. The impact mechanism is designed on a new principle involving the use of rotatively striking impact jaws developed to maintain steady, full striking power on production, assembly, or maintenance work. 92



Thor Pneumatic Impact Wrench Made by the Independent Pneumatic Tool Co.

Sidney Lathes

*Designed
to be equipped
with*

TOOL STEEL WAYS

In addition to the four continuous longitudinal walls, with cross girts at 12" intervals on sizes up to 20" and 24" intervals on the larger machines, Sidney Lathe beds can be equipped with tool steel ways if desired.

The tool steel ways are ground in place on the machine providing longer life—and dependable accuracy.

This bed design provides three Vees and a flat. The two well proportioned outside Vee Ways take downward thrust and twisting strains and accurately guide the carriage for straight or taper turning and boring.

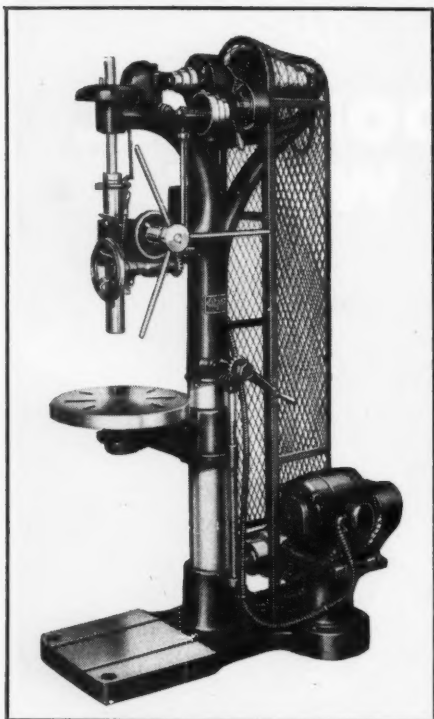
The end result is greater rigidity—less chance for misalignment and continued accuracy.

Bulletins on all sizes available



Sibley Drilling Machine

The development of a 20-inch drilling machine for drilling holes up to 1 1/4 inches diameter in cast iron or the equivalent in other metals has just been announced by the Sibley Machine & Foundry Corporation, South Bend 23, Ind. This machine is designed as a standard unit with motor drive and belt guard. When it is desired to employ a line-shaft drive, the machine can be furnished with tight and loose pulleys.



Drilling Machine Developed by Sibley Machine & Foundry Corporation

A rotary geared coolant pump and geared tapping attachment are also available.

The drilling table can be rotated on an arm designed to swing on the main column, which has a diameter of 5 1/4 inches. Both power and hand feed are furnished. Means for making adjustments to compensate for wear between the worm and worm-gear are provided.

Features of this new machine include wide interchangeability of all parts, which are machined to assure accurate fits. Spindle quills are furnished with bronze oil-grooved bushings and have heavy-duty ball thrust bearings. The Morse taper is bored in the spindle end after assembly to insure accurate alignment. Large back-gears of the correct driving ratio deliver ample power for heavy loads. The table arm is bored after

assembly with the same spindle furnished on the machine to obtain alignment of the table at right angles to the spindle within limits of 0.0007 inch in 6 inches.93

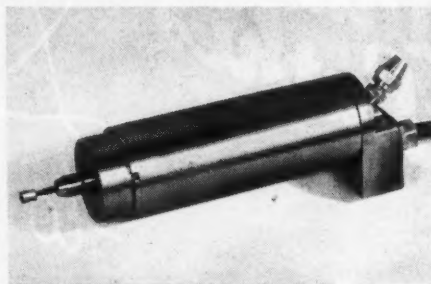


Fig. 1. Ex-Cell-O High-cycle Grinding Spindle with Chuck and Mounted Wheel

High-Cycle Grinding Spindle and Frequency Generator

A small grinding spindle with abundant speed and power for finishing small holes efficiently was exhibited by the Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 6, Mich., at the recent show in Cleveland. This new grinding spindle is especially suited for use on small grinders for finishing holes from 3/32 to 3/16 inch in diameter. It can be employed to increase the efficiency of old grinders, as well as to improve the appearance and operating characteristics of modern machines.

A high-cycle motor, which develops 1/4 H.P. at 65,000 R.P.M., is built into the spindle and has been designed to eliminate vibration, give

a better finish, and provide more power for maintaining the wheel speed. Oil mist lubrication cools and lubricates the precision bearings and assures a continuous film of oil on moving parts, but does not permit an accumulation of oil, which would cause excessive heat at high speeds.

The shaft of the spindle has an accurate taper hole and threads for inserting removable quill chucks which accommodate mounted wheels having 3/32- and 1/8-inch shanks. The new grinding spindle operates

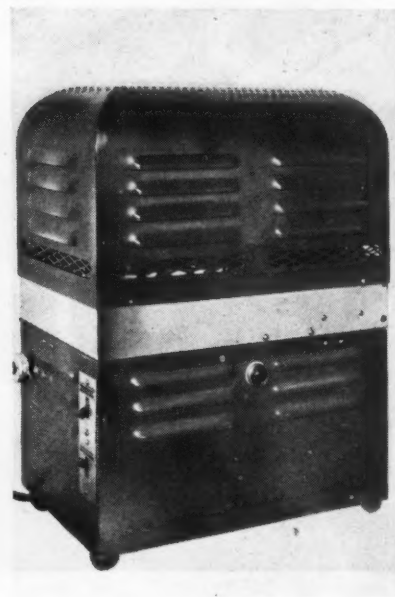


Fig. 3. Frequency Generator Used with Ex-Cell-O High-cycle Spindle

on 110-volt, 1080-cycle, two-phase current obtained from a frequency generator that operates from 110-

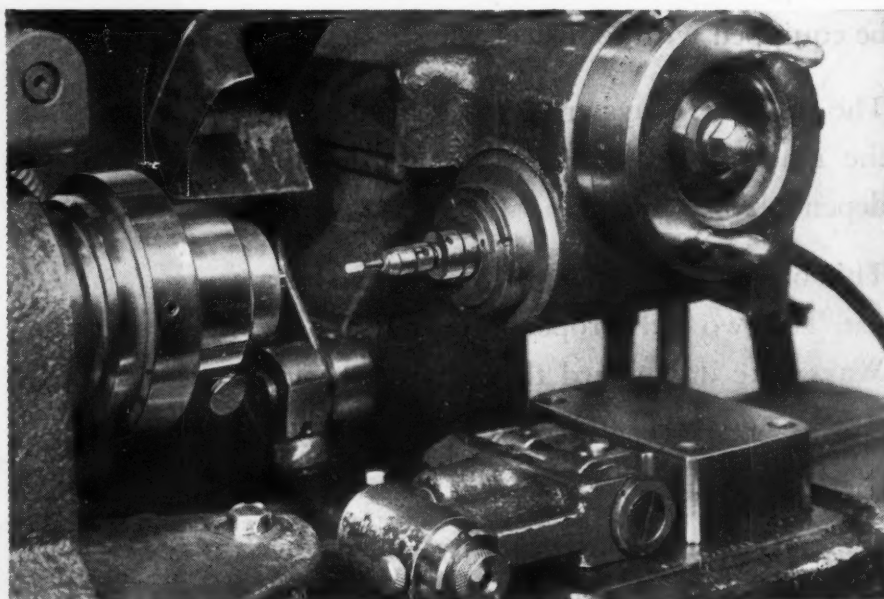
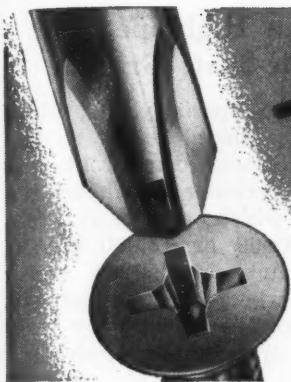


Fig. 2. High-cycle Spindle Shown in Fig. 1 Mounted in a Small Finishing Machine



INDEPENDENT INVESTIGATOR'S STUDY SHOWS

*Phillips Screws give each assembler
a needed "extra hand," and costly
driver skids at*

SERVEL

"WE couldn't possibly use slotted screws in these door panels," the chief cabinet engineer at Servel, Inc. told the investigator. "We know, from actual tests. In many places it would be impossible to guide a slotted screw with the driver except at a snail's pace, and our driver skid damage would be terrific."

TO GET THE COMPLETE FACTS on how this leading refrigerator manufacturer enlists the many advantages of Phillips Screws, the investigator asked the same questions you would ask—learned how they make big savings day after day—the kind of savings you can't afford to miss with today's squeeze on profits.

THIS REPORT, with others now ready, and more to come—comprise a practical manual of modern assembly methods, never-before-printed information, inside facts you'd pay good money to get, and you can have them now, **FREE!**



This investigator from James O. Peck Co., industrial research authorities, is visiting representative plants to get authentic facts for you on assembly savings.

HIGHLIGHTS FROM THE SERVEL REPORT

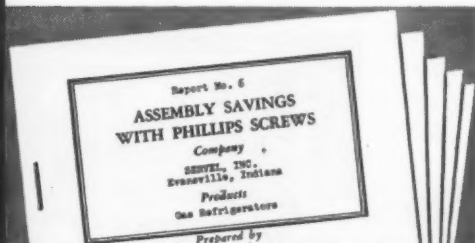
"AN ASSEMBLER WOULD NEED THREE HANDS to drive slotted screws under the rubber gasket in fastening inner door panels and even then, driver skid damage would be prohibitive. The Phillips driver is self-centering—makes it easy to guide the screw with one hand.

"IT COSTS MONEY to replace door panels punctured by skidding drivers, figuring the cost of a new panel, and time for taking out and replacing up to 43 screws. Slips are no problem with Phillips Screws. This advantage alone saves *plenty* in our big production.

"WE RAN A TEST six years ago on door assembly to prove that Phillips Screws cost much less to use than slotted. It was so convincing, no one ever suggested using slotted screws again in this application."

GET THESE REPORTS . . . READ THE COMPLETE FACTS . . . LEARN HOW YOU, TOO, CAN CUT ASSEMBLY COSTS!

All types of products are covered—metal, plastic, wood. The coupon will bring the reports ready now and the rest as they are issued. Fill it in and mail it, **TODAY!**



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of
American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.

26 SOURCES

Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation

Pawtucket Screw Co.
Pheoli Manufacturing Co.
Reading Screw Co.
Russell Burdall & Ward
Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Wolverine Bolt Company

PHILLIPS SCREW MFRS.,
c/o Horton-Noyes

2300 Industrial Trust Bldg., Providence, R. I.

Please put me on the list to receive all reports on
Assembly Savings with Phillips Screws

Name

Company

Address

220-, or 440-volt, 60-cycle, single-phase lines. The generator, shown in Fig. 3, can be ordered with the spindle. 94

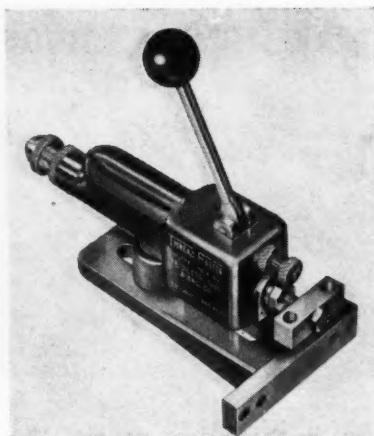
Lawrenz "Thread Faster" Attachment for Lathes

The Lawrenz "Thread Faster" lathe attachment, shown in the accompanying illustration, which was originally made for war production is now being manufactured for the trade by the Peerless Tool & Engineering Co., 1127 N. Kilbourn, Chicago 51, Ill. This attachment is designed to retract the tool bit at precisely the same point each time a threading or chasing cut is taken on a lathe. It can be used in cutting either internal or external threads at top speeds. These features make it possible to use carbide tools to better advantage by eliminating the danger of tool breakage or damage to the work from "over-running."

The "Thread Faster" is applicable to any bench lathe up to 12-inch swing which has threading facilities. It is especially recommended for production runs that are not sufficiently large to warrant the use of automatic equipment. 95

General Electric Strain-Gage Amplifier

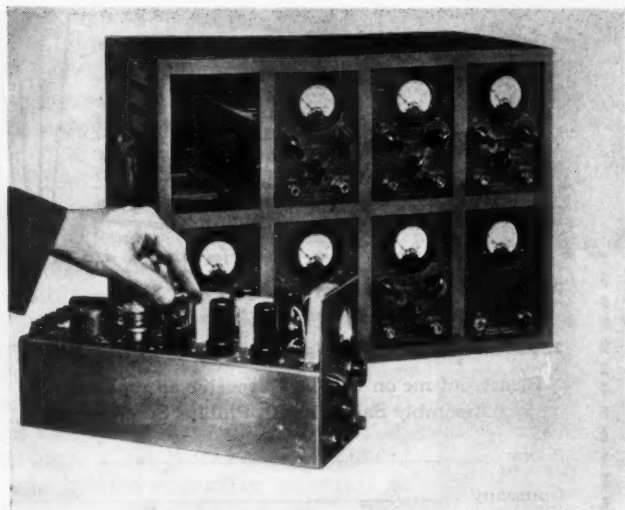
A strain-gage amplifier designed for use with resistance-wire, electromagnetic and "magneto-restrictive" strain gages for amplifying small electrical signals varying in frequencies from 0 to 1000 cycles per second has been added to the line of



Lawrenz "Thread Faster" Attachment Made by Peerless Tool & Engineering Co.

strain-gage equipment made by the General Electric Co., Schenectady 5, N. Y. This new amplifier is operated in conjunction with either a magnetic oscillograph or a cathode-ray oscilloscope. This small light-weight instrument is suitable for aircraft flight-testing applications when the test equipment must be taken aboard a plane, as well as for use in development and testing laboratories and production shops. It is available for use on 115-volt, 60-cycle alternating-current lines or for battery operation at 24 volts.

The strain-gage amplifier consists essentially of a 5000-cycle oscillator unit, a power unit, and either two or six identical amplifier units, all mounted in separate chassis in a sturdy case. The amplifier channels are stabilized against line-voltage change or variations in tube characteristics, and each can be removed for servicing and inspection.....96



General Electric Strain-gage Amplifier with One Channel Removed for Servicing

Leigh High-Speed Flexible-Shaft Grinder

The Spring Specialty Co., Maywood, Ill., has placed on the market a new high-speed direct-connected flexible-shaft grinder designated the Leigh VB-2, which operates at a free speed of 17,000 or 18,000 R.P.M. Mounted points, polishing disks, drums, and wheels up to 1 inch in diameter can be driven by this machine at their proper operating speeds.

The equipment comprises a newly developed, extremely flexible high-speed shaft with a patented inner liner and a special type ball-bearing spindle. This spindle has an integral, key-operated 1/4-inch collet, and can also be provided with auxiliary insert reducing collets which accommodate 1/8-, 3/32-, and 3/16-inch arbors.

The 1/4-H.P. driving motor operates on either alternating or direct current, and is provided with an end ring for suspension and a rubber-footed base for bench use. A variable rheostat or line switch can be supplied. A variety of arbors, mounted wheels, rotary files, rubber drums, polishing chucks, etc., are available as accessories.97

* * *

The number of men employed to keep a modern industrial plant clean probably could have cleaned all the industrial buildings in Detroit in 1896. The Ford Motor Co. at its Rouge plant in Dearborn, Mich., employs 5000 men in such maintenance work as washing windows, sweeping and mopping floors, picking up scrap paper, dusting, scrubbing, etc.

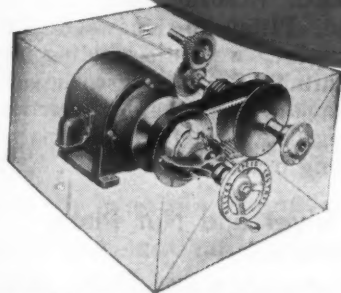
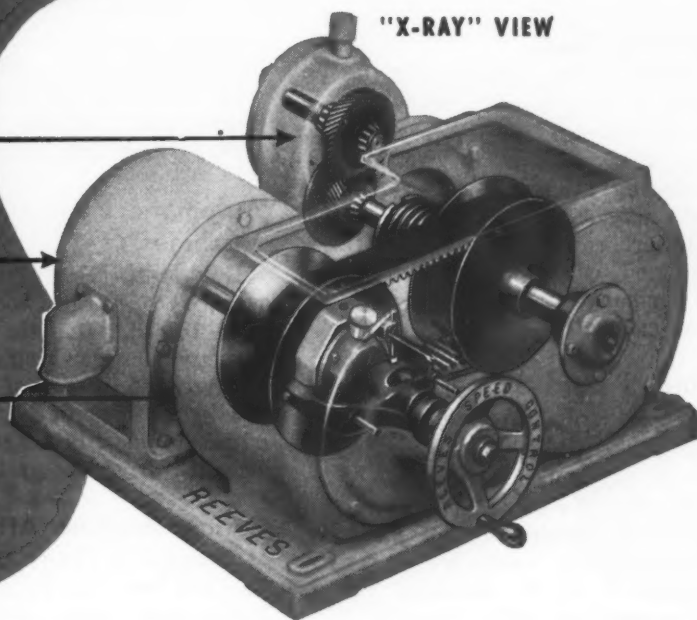


Leigh Flexible-shaft Grinder Placed on the Market by the Spring Specialty Co.

REEVES MOTODRIVE

*Wraps up All Three in
one compact package*

- 1 GEAR REDUCER:** Single, double or triple helical type reduction gears, as required.
- 2 CONSTANT SPEED MOTOR:** Any standard make, ball-bearing foot-type, may be specified.
- 3 VARIABLE SPEED MECHANISM:** Time-tested REEVES speed varying mechanism for stepless speed adjustability.



The REEVES Motodrive is a complete, totally enclosed, accurate variable speed power plant. It will drive any production machine at infinitely

variable speeds, making available instantly the most efficient speed for every changing condition.

This compact, modern variable speed drive is widely used where space is limited or where direct connection is desirable. An outstanding advantage is that any make, foot type, ball-bearing constant speed motor in standard NEMA dimensions may be specified.

Simple, rugged, dependable, the Motodrive utilizes the time-tested REEVES principle of a V-belt driving

between two pairs of cone-shaped discs which are adjustable to form an infinite number of driving and driven diameters. *The transmission of power is accurate at all speeds.*

Two space-saving designs—horizontal and vertical—each built in six basic sizes from $\frac{1}{4}$ to 15 h.p., covering ratios of speed range from 2:1 through 6:1. By reason of the many different sizes, speed ratios and reduction gear combinations available, you can obtain REEVES Motodrives with output speeds as low as 1.35 r.p.m.; others as high as 3,480 r.p.m. Handwheel control for speed shifting is standard, but Electric Remote is also available. Nation-wide engineering and service facilities. For full information on Motodrive and the two other basic REEVES units—Transmission and Variable Speed Motor Pulley—write for 96-page catalog M-450.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

Accurate Variable
REEVES Speed Control
Gives the Right Speed for Every Job!

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 235 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the June, 1946, Number of MACHINERY

Cutting Tools

ECLIPSE COUNTERBORE CO., 1600 Bonner Ave., Detroit 20, Mich. Catalogue covering the Eclipse complete line of production and cutting tools, including tungsten-carbide tipped cutters, special holders and drives, counterbore sets, etc. Copies can be obtained by sending request directly to company, stating name, title, and firm connection.

Thread Data Slide-Rule

CAPELL DESIGNING CO., Box 993, Church St. Station, New York 8, N. Y. Circular announcing "The Quickslide," a slide-rule for quickly obtaining minimum and maximum measurements over wires for all classes of U. S. standard threads corresponding with various pitch diameters, major diameters, best wire sizes, etc.1

Milling and Boring Machines

KEARNEY & TRECKER CORPORATION, Milwaukee 14, Wis. 48-page general catalogue E-53, covering the company's entire line of milling machines and boring and milling machines, together with their accessories. Specifications for all machines are given in both English and metric designations.2

Chucking Machines

NATIONAL ACME CO., 170 E. 131st St., Cleveland 8, Ohio. Bulletin SC-46, describing the new Acme-Gridley 12-inch single-spindle Chuck-Matic for performing heavy-duty high-production metal-turning operations on castings, forgings, and tubing parts up to 12 inches in diameter...3

Bronze-on-Steel Bearing Alloy

JOHNSON BRONZE CO., 520 S. Mill St., New Castle, Pa. Circular descriptive of Johnson bronze-on-steel,

a newly developed pre-cast bearing material combining the strength of steel with the bearing qualities of bronze and available in rolls or as finished bearings, washers, etc.4

Automatic Linear Dividing Machines

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago 14, Ill. Bulletin 153-64, illustrating and describing the company's newly expanded line of precision and production machines for the automatic ruling of linear scales in either the inch or metric system.5

Boring Machine Attachments

GIDDINGS & LEWIS MACHINE TOOL CO., 140 Doty St., Fond du Lac, Wis. Forty-eight page book describing over sixty accessories and attachments for Giddings & Lewis horizontal boring, drilling, and milling machines, designed to save time and labor.6

Research Data

ARMOUR RESEARCH FOUNDATION OF ILLINOIS INSTITUTE OF TECHNOLOGY, Chicago 16, Ill. Pamphlet describing the facilities of the Research Foundation for engineering research and its activities in the fields of metallurgy, physics, chemistry, etc., during 1944-1945.7

Electronic Guide

WESTINGHOUSE ELECTRIC CORPORATION, Lamp Division, Bloomfield, N. J. Booklet A-4726, entitled "The Business Men's Guide to Electronics," describing the six fundamental functions of electronic tubes and the tubes required for each function....8

Welding Equipment

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GE3388, en-

titled "Step up Production and Lower Costs with High-Speed Resistance Welding," outlining the fundamental principles of resistance welding and typical applications.9

Precision Jig Boring and Milling Machines

COSA CORPORATION, 5000-4 Chrysler Bldg., New York 17, N. Y. Catalogue illustrating and describing in detail the new Sip Hydroptic-B, a hydraulic machine, with optical settings, for precision drilling, boring, and milling.10

Plastic Molding Material for Electrical Insulation

GENERAL ELECTRIC CO., Plastics Division, Pittsfield, Mass. Booklet on "Mycalex," a plastic molding material suitable for parts used in electrical apparatus; covers properties, types, molded parts, fabricated parts, machining practice, etc.11

Blind Rivet and Nut Plate Combination

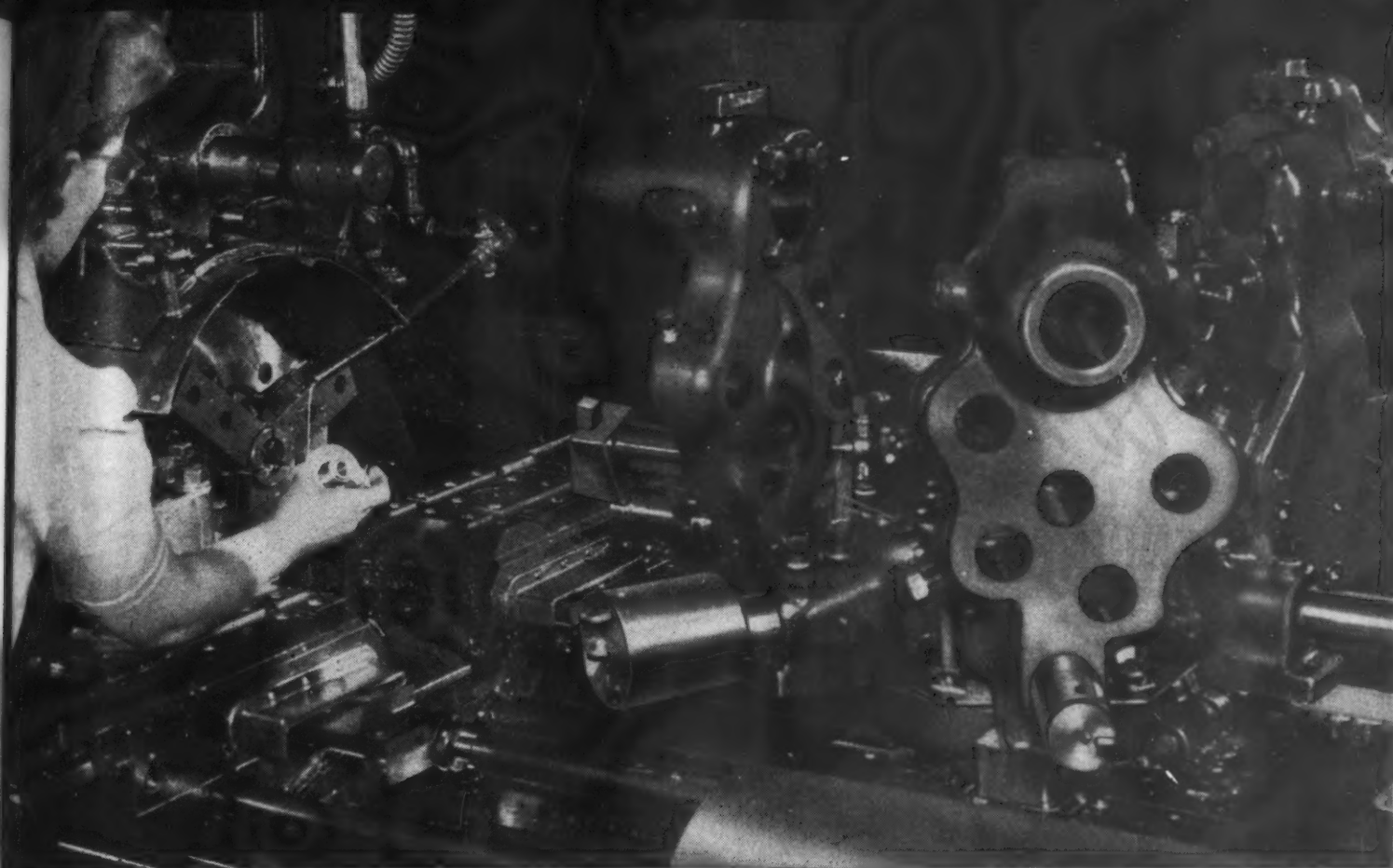
B. F. GOODRICH CO., Akron, Ohio. Booklet entitled "I'm Always Getting into Other People's Business"—one of a series of instructive booklets dealing with the "Rivnut," a one-piece blind rivet and blind nut plate combination.12

Protective Coating for Steel and Non-Ferrous Sheets

EDGCOMB STEEL CO., 460 Hillside Ave., Hillside 5, N. J. Circular announcing "Liquid Envelope," a plastic film for protecting steel and non-ferrous sheet prior to cutting and fabricating operations.13

Vibro-Levelers

BUSHINGS, INC., Coolidge at 14-Mile Road, Royal Oak, Mich. Bulletin BU50, on "Vibro-Levelers," machin-



Production Multiplied by Four with the **FASTERMATIC**

• Where you have a part like this, requiring as many as six operations in one chucking, you have an ideal job for the FASTERMATIC.

Here, for example, the machining of gear blanks calls for a series of rough and finish turning, facing, and boring operations which formerly required eight minutes per part. With the FASTERMATIC, all these cuts are handled with the advantage of a completely automatic machining cycle. Time was reduced to only two minutes per part—a saving of 75%. And costs were reduced by 14 cents per piece.

The ability to handle a large number of operations in one chucking and require but little of the operator beyond loading and unloading the work, makes the FASTERMATIC a most profitable investment in low-cost production. Write for literature.



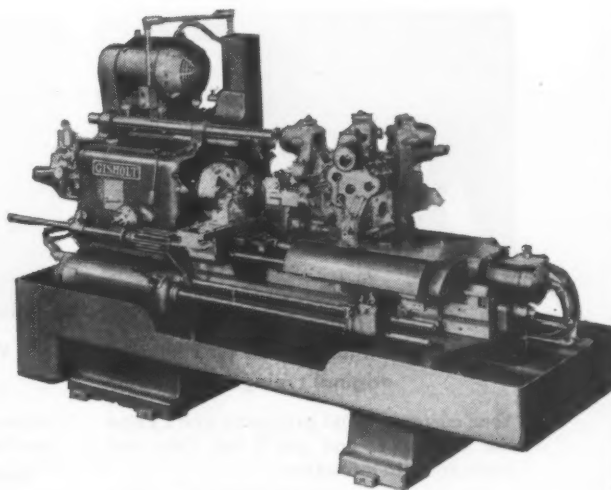
GISHOLT MACHINE COMPANY

1209 East Washington Ave. • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . with Gisholt

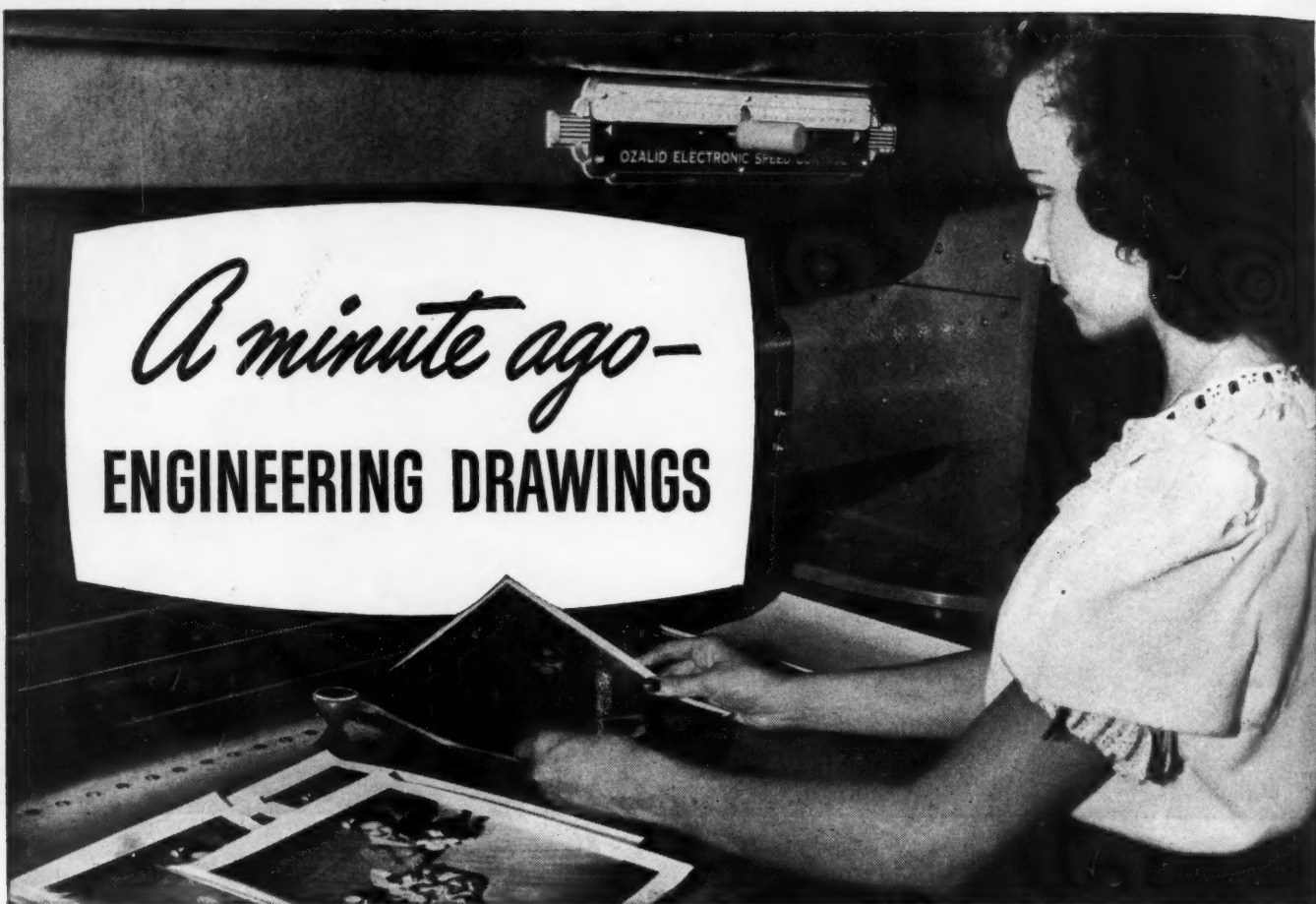


On these gear blanks, six operations are completed in 105 seconds, actual cutting time. Floor-to-floor time is 125 seconds.



The FASTERMATIC is a universal automatic turret lathe for both high and low production machining. It is equipped with a hydraulic feed system, automatically controlled by standard feed cams.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



AND NOW it's photographic material that's being reproduced . . . in the same OZALID machine, in exactly the same manner.

You see the operator feeding the "MASTER" and a sheet of Ozalid sensitized material into the machine. That's all that has to be done.

In just twelve seconds a beautiful positive copy will be delivered—dry, ready for immediate use—like the prints

on the feedboard.

It's the same quick, simple routine when you're reproducing engineering drawings, office forms, or typed reports. And, in addition, there's this important advantage, realized only with OZALID:

You can select any one of ten different types of Ozalid material . . . and reproduce the lines or images of your original in the color you prefer—black, blue, red, or sepia . . . and on the base

you prefer—paper, cloth, foil, or film.

Thus, you can always match the print to the job at hand!

For example, in reproducing continuous-tone photographic subjects, you'll probably use OZALID DRYPHOTO, which gives you lustrous prints with all the tonal values present in the original. Just the thing for unique advertising displays or dramatic presentation of your products in sales catalogs.

Available now are OZALID MACHINES for large, medium, and occasional print production requirements.

Which ever model you choose, you have the same versatility.

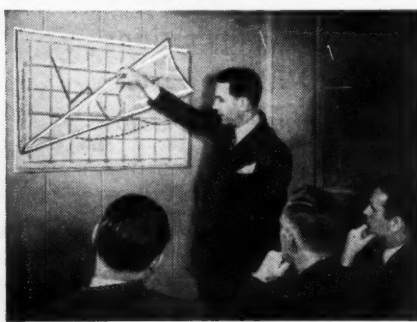
Learn the complete story . . . and see samples of the ten types of Ozalid prints you will be able to make. Write today for free booklet No. 99.



Want form letters that look like original typing?

Your customers and prospects won't know the difference, and you'll cut time and labor costs to a fraction.

Just have the original typing done on a translucent letterhead and make Ozalid Rapid Black prints directly from it. On these, fill in the headings and references with the same make of typewriter used to prepare original.



Want transparent overlays in different colors?

Artists labored for days to do what can now be done in minutes.

Instead of applying inks or paints to nonabsorbent surfaces, you simply draw individual details in pen or pencil on separate sheets of translucent paper . . . and reproduce each on an Ozachrome film of the desired color. The job is finished by merely overlaying the Ozachromes in register.

OZALID

Division of
GENERAL ANILINE AND FILM CORPORATION
JOHNSON CITY, NEW YORK

Ozalid in Canada
Hughes Owens Co., Ltd., Montreal

ery mountings designed to stop transmission of vibration and also to provide a means of leveling machines. 14

Aluminum-Bronze Alloys

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 72, listing the physical properties of Ampco aluminum-bronze and copper-base alloys and showing some of the recent products made from these metals. 15

Hydraulic Tube Fittings

FLODAR CORPORATION, 331 Frankfort Ave., Cleveland 11, Ohio. Catalogue 101, illustrating and describing the "Grip Tube," a tube fitting designed to seal higher fluid pressures and absorb excessive vibration. 16

Carbide-Tipped End-Mills

SUPER TOOL CO., 21650 Hoover Road, Detroit 13, Mich. Folder containing data on carbide-tipped solid end-mills of value in selecting the correct tool for a given job. Feeds and speeds are included. 17

Electronic Temperature Control

WHEELCO INSTRUMENTS CO., 847 W. Harrison St., Chicago 7, Ill. Bulletin D4-2, describing the "Multronic Capacitrol," the newest development in this company's line of electronic temperature control instruments. 18

Punches and Dies

GEORGE F. MARCHANT CO., 1420 Rockwell St., Chicago, Ill. Catalogue

46, describing this company's line of punches, dies, couplings, rivet sets, and other tools; contains sketches with full dimensional details. 19

Firthite Sintered-Carbide Tools

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular describing a case history of the results obtained with Firthite sintered-carbide tools in rough-facing cast-iron motor housings. 20

Drill Chip Breaker

CONTINENTAL TOOL WORKS, DIVISION OF EX-CELL-O CORPORATION, Detroit 6, Mich. Bulletin 28161, descriptive of the Continental drill chip breaker; includes installation and operating instructions. 21

Dust Collectors

IDEAL INDUSTRIES, INC., 1011 Park Ave., Sycamore, Ill. Circular illustrating and describing several of this company's products, including dust collectors, etchers, demagnetizers, chucks, live centers, etc. 22

Controlled-Quality Steels

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh 30, Pa. Circular containing data on the properties and applications of Otiscoloy, a high-tensile, low-alloy corrosion-resistant steel. 23

Automatic Material Racks

AMERICAN MACHINE & FOUNDRY CO., 511 Fifth Ave., New York 17, N. Y. Circular illustrating and describing portable material racks de-

signed to automatically bring materials to operator's working level. 24

Universal Testing Machines

TINIUS OLSEN TESTING MACHINE CO., 530 N. 12th St., Philadelphia 23, Pa. Catalogue 30, covering the company's entire line of universal testing machines for tension, compression, and flexure testing. 25

Worm Hobs

BRAD FOOTE GEAR WORKS, 1309 S. Cicero Ave., Cicero 50, Ill. Catalogue Section 9, listing 700 different standard worm hobs, with all necessary dimensions, carried in stock, ready for customer's use. 26

Split Ball Bearings

SPLIT BALLBEARING CORPORATION, Lebanon, N. H. Catalogue 84, containing specifications covering sizes and load ratings of a complete line of divisible-race ball, roller, and thrust bearings. 27

Tube-End Forming Machine

VAILL ENGINEERING CO., 17 Brown St., Waterbury 89, Conn. Bulletin describing the new Vaill tube-end forming machine for beading, flaring, flanging, expanding, and reducing operations. 28

Lathe Attachment

DUNN ENGINEERING CO., 6341 Lyndon Ave., Detroit 21, Mich. Circular 464, illustrating and describing the "Dunamatic" lathe attachment for producing small parts automatically at low cost. 29

To Obtain Copies of New Trade Literature

listed on pages 232-236 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Name.....Position or Title.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm.....

Business Address.....

City.....State.....

[SEE OTHER SIDE]

Steel Racks

MASSEY MACHINE Co., 800 Pearl St., Watertown, N. Y. Bulletin SR-46, illustrating a new line of steel racks for stacking and handling rods, bars, tubing, and plate and sheet iron.30

Diamond Tools

PRECISION DIAMOND TOOL Co., 102 S. Grove Ave., Elgin, Ill. Catalogue containing engineering data on the proper selection and application of Diamond tools and Diamond grinding wheels.31

Bench Milling Machines

AIRCRAFT MACHINERY CORPORATION, Burbank, Calif. Circular on the new Armor bench milling machine, which embodies features previously found only in large milling machines.32

Injection Molding Machines

HYDRAULIC PRESS MFG. Co., Mount Gilead, Ohio. Bulletin 4601, describing the operating and production features of the HPM "Turbojector" designed for the injection molding of rubber.33

Free-Machining Steel Plates

JOSEPH T. RYERSON & SON, INC., Chicago, Ill. Bulletin containing data on physical properties and applications of "E-Z-Cut" free-machining casehardening steel plates.34

Profilometers

PHYSICISTS RESEARCH Co., 321 S. Main St., Ann Arbor, Mich. Cata-

logue containing information on Profilometer equipment for measuring surface roughness.35

Taper Inspection Plate

EX-CELL-O CORPORATION, Detroit 6, Mich. Bulletin 50161, illustrating and describing the Ex-Cell-O inspection plate for checking tapers and angles with sine bar accuracy.36

Shop Floors

NORTON Co., Worcester 6, Mass. Circular 1935-4P, on Norton alundum aggregate and other types of "non-slip" floors for factories and public buildings.37

Resistance Welders

FEDERAL MACHINE & WELDER Co., 208 Dana St., Warren, Ohio. Bulletin SP 345, describing basic types of Federal resistance welders and their applications.38

Magnetic Chucks

ROCKFORD MAGNETIC PRODUCTS Co., 1302 Eighteenth Ave., Rockford, Ill. Catalogue describing "Power-Grip" magnetic chucks and their application.39

Carbide Cutting Tools

ACROMATIC TOOL Co., 640 E. State Fair, Detroit 3, Mich. Catalogue 46, covering this company's complete line of carbide-tipped tools and high-speed cutting tools.40

Vari-Speed Lathe

PRECISE PRODUCTS Co., 1328-30 Clark St., Racine, Wis. Bulletin E-3,

illustrating and describing the Vari-Speed lathe for grinding, deburring, finishing, and polishing.41

Portable Power Saw and File

MID-STATES EQUIPMENT CORPORATION, 2533 E. 73rd St., Chicago 49, Ill. Folder illustrating and describing the "Saw-Gun" portable power saw and file.42

"Tru-Torque" Screwdrivers

AIRDRAULICS ENGINEERING, INC., New Canaan, Conn. Leaflet describing a new line of "Tru-Torque" screwdrivers designed to operate at a predetermined torque.43

Industrial Safety Equipment

AMERICAN OPTICAL Co., Southbridge, Mass. Bulletins covering twenty new products of the company, including safety goggles, gloves, shoes, etc.44

Light-Duty Lathe Chucks

WESTCOTT CHUCK Co., Oneida, N. Y. Leaflet describing the new Westcott line of light-duty threaded lathe chucks.45

Optical Flats

ACME SCIENTIFIC Co., 200 N. Laflin St., Chicago 7, Ill. Bulletin 453, listing stock sizes of optical flats for measuring flatness by light waves...46

Broaching Practice

BROACHING TOOL INSTITUTE, 74 Trinity Place, New York 6, N. Y. Bulletin entitled "Trends in Broaching."47

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 199-230 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the

identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in June, 1946, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on page 198, fill in below the identifying number found at the end of each

description—or write directly to the manufacturer, mentioning name of material as described in June, 1946, MACHINERY.

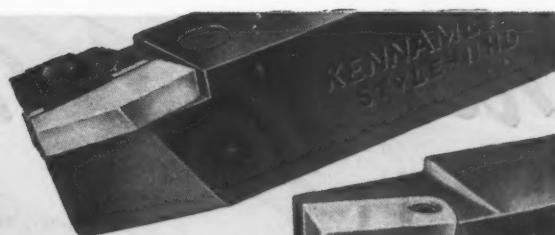
No.	No.	No.	No.	No.	No.	No.	No.	No.
-----	-----	-----	-----	-----	-----	-----	-----	-----

Fill in your name and address on other side of this blank.

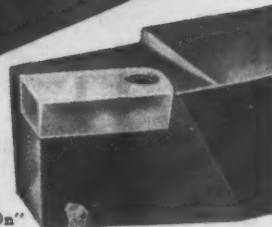
Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

[SEE OTHER SIDE]

Here's What KENNAMETAL HAS DONE



STYLE 11HD
with "Clamped-On"
Kennametal blank



STYLE 11
with "Screwed-On"
Kennametal blank

*that other cutting tools
COULD NOT DO!*

STYLE 1

on Sandy Iron Castings

Turned cast iron piston trunks—21½" diameter x 45" long—high in silicon, manganese, and carbon; very sandy surface; chilled around port holes. Showed practically no wear after machining three complete castings. This was Kennametal's new and improved tungsten carbide Grade K6.

Other makes were unable to take shock of interruptions, or withstand the highly abrasive cutting—could not complete one casting.

on Tough, Aluminum Bronze

Rough turned scaly Ampco metal bar stock—6" diameter x 14" long—continuously for 8 days. After turning 224 pieces (equivalent to 85 miles of lineal cutting) Kennametal tool did not need regrinding.

With other tools only one-fourth as many pieces could be machined before resharpening was needed.

on Chrome Nickel Steel

Rough turned very scaly chrome nickel forging—2" diameter x 10" long—in 30% less time, and with triple the tool life obtained from other tools, which could not stand up under the plunge cut through scale.

on Monel Metal

Bored 4½" hole in 6' long solid monel metal forging, to accurate size, in 32 minutes. HSS tool required 10 hours; sometimes produced up to .040" taper, due to wear, which required reborring.

on 14% Manganese Steel

Successfully rough and finish bored and turned huge casting. (High manganese steel is usually ground rather than machined because it hardens under cutting tool pressure.)

on "Everyday" Jobs, Too

The tool that takes tough jobs in stride is the one to use on routine production runs where overall cost-per-piece is the important factor. This is conclusively proved by official reports covering consumption of cemented carbides used during the war for machining 105mm shells:

- Where cemented carbide tools other than Kennametal were used, average carbide consumption per shell produced was approximately 3 calculated grams.
- In typical plants using Kennametal exclusively, average consumption per shell was only ½ gram.

In other words—Kennametal Tools were up to 6 times as serviceable—a fact of utmost significance to all who must now manufacture post-war products—economically.



KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.

News of the Industry

California

MOORE MACHINERY Co., 3876 Santa Fe Ave., Los Angeles 11, Calif., announces the purchase of the assets and accounts of the EMPIRE MACHINERY Co., 2328 Santa Fe Ave., Los Angeles. M. FRANK STRAUSS, JAMES L. BUCKLEY, and KIMBALL D. SMITH have been retained in the employ of the Moore Machinery Co.

IRVING C. MAUST has been appointed a member of the West Coast sales engineering staff of Foote Bros. Gear & Machine Corporation, Chicago, Ill. He will be located at Pasadena, Calif. Mr. Maust was formerly associated with the Lockheed Aircraft Corporation.

FRED W. HERMAN, chief engineer of the Douglas Aircraft Co.'s Long Beach, Calif., plant since 1941, has been appointed plant manager. He succeeds A. C. WALLEN, who has been transferred to the company's Santa Monica plant as production manager.

District of Columbia and Maryland

ALWIN A. GLOETZNER has been appointed head of the new southeastern district for the New Departure Division of General Motors Corporation, Bristol, Conn. He was previously in charge of the Washington office, acting as a special representative of the company. Mr. Gloetzner will continue to make his headquarters at 1154 National Press Bldg., Washington, D. C. His territory will include the District of Columbia, southern and western Maryland, Virginia, eastern Tennessee, North and South Carolina, Alabama, Georgia, and Florida.

GEROTOR MAY CORPORATION, Baltimore, Md., manufacturer of air and hydraulic units for industrial applications, announces the consolidation of its Logansport, Ind., plant with the main plant in Baltimore.

Illinois, Indiana, and Missouri

GENN & LOGAN, 3959 N. Lincoln Ave., Chicago 13, Ill., is a new concern formed to represent the C. M. KEMP Mfg. Co., of Baltimore, Md., manufacturer of industrial equipment and machinery for process heating, metal melting, industrial combustion, gas carburetion, atmosphere generation, etc. The principals of the new firm, EARL GENN and FREDERICK D. LOGAN, have both been active in the sales and development end of industrial gas utilization for some years, having formerly been vice-president and chief

engineer, respectively, of Gas Appliance Service, Inc., Chicago, Ill. The territory handled by the new concern embraces northern Indiana, northern Illinois, southwestern Michigan, and southern Wisconsin, as well as Iowa, Minnesota, North Dakota, and South Dakota.

RESISTORS, INC., 2241 Indiana Ave., Chicago 16, Ill., has been organized by Joseph J. Cerny, formerly president and general manager of Lectrohm, Inc. The new concern will engage in the manufacture of a complete line of resistors, as well as rheostats, small-capacity solder pots, metal resistor cages, and heating elements.

CHARLES I. KRAUS has been appointed sales manager of the Alemite Distribution Division of the Stewart-Warner Corporation, Chicago, Ill., and GUSTAVE TREFFEISEN has been made assistant sales manager.

O. K. STAMPING CORPORATION has recently been organized at Fort Wayne, Ind., to do contract work in metal stamping and production. The principals in the new corporation are F. A. McGUIRE and J. P. McGUIRE, owners of the O. K. Machine Co., and H. J. COCKS, a partner in the former Morco Mfg. Co. The new company has purchased the building previously owned by the Morco concern. Mr. Cocks will be general manager.

TITAN METAL MFG. Co., Bellefonte, Pa., manufacturer of brass and bronze rods, forgings, die-castings, and welding rods, has appointed ROY A. EGELHOFF sales representative for the company in Iowa, Kansas, Missouri, southern Illinois, and southwestern Indiana, with headquarters at 817 Arcade Bldg., St. Louis, Mo.

M. E. BURKHART has joined the K. P. Wesseling Co., 13th and Locust Sts., St. Louis, Mo., manufacturers' agent, as vice-president in charge of a new engineering department that will provide machine tool customers with engineering consultant service.

Kentucky and Texas

C. C. McDERMOND has been appointed representative of the Welding Fittings Division of Tube Turns, Inc., Louisville, Ky., in Venezuela and Colombia, South America. His headquarters are at Apartado 331, Maracaibo, Venezuela. Mr. McDermond will be assisted by C. T. McCoy.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the BRIGGS-WEAVER MACHINERY Co., 309 N. Market St., Dallas 2, Tex., distributor for the company's cemented-carbide tipped tools in the north Texas area.

Michigan and Wisconsin

MARSHALL M. SMITH, who recently returned from Great Britain and France, where he has been managing the operations of the British and French companies of the E. W. Bliss Co. for the



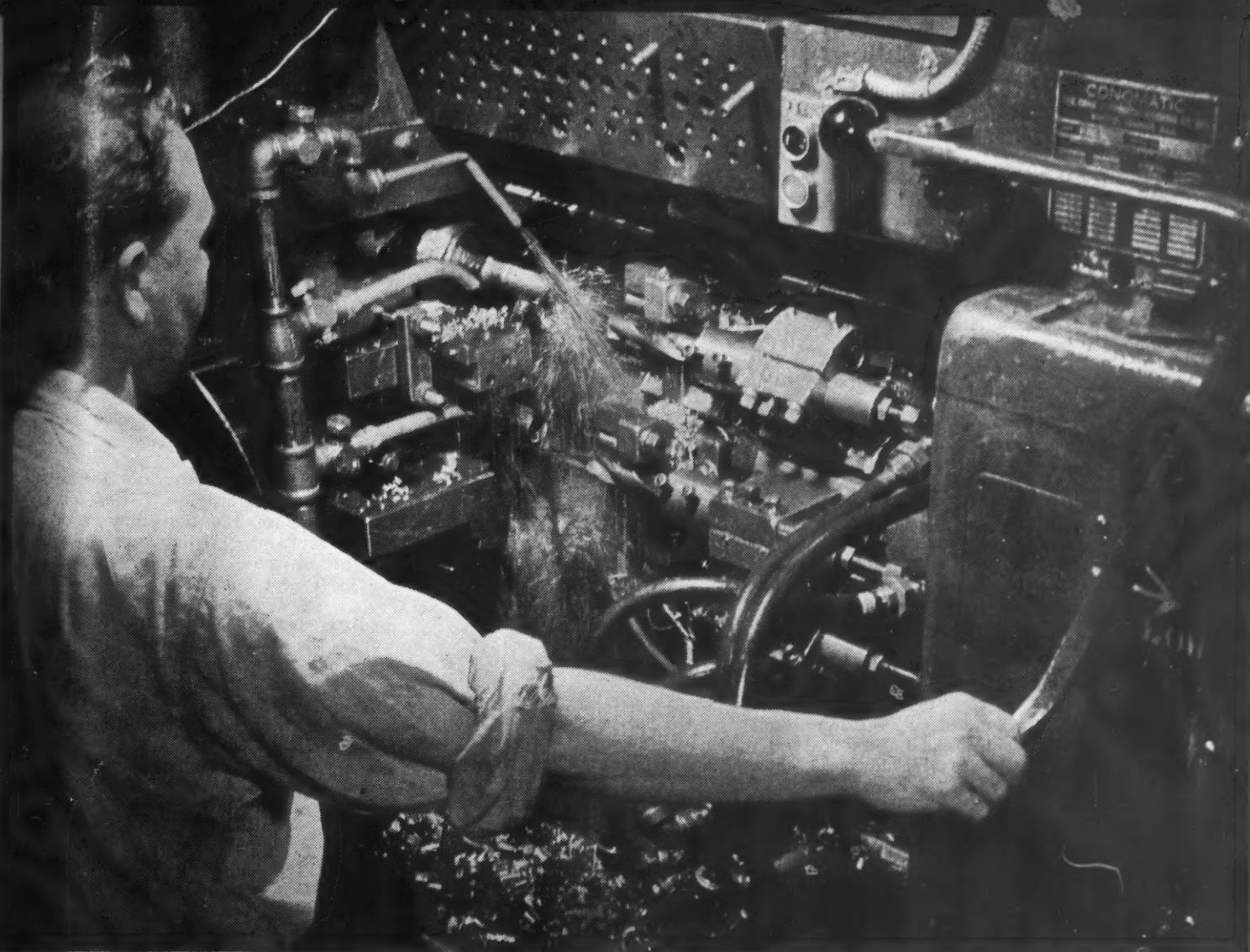
Marshall M. Smith, New Assistant General Sales Manager, E. W. Bliss Co.

last nine months, has been named assistant general sales manager of the company. Mr. Smith will be located in the company's newly established executive offices at 450 Amsterdam St., Detroit, Mich. He will continue to supervise all Bliss export sales, as well as the foreign operations at the company's plants in Derby, England, and in Paris, France.

DAVIS & FRENCH, INC., 7376 Grand River Ave., Detroit 4, Mich., has been organized to act as manufacturers' representatives by MARVIN W. DAVIS, formerly associated with Hanson & Co., and CHARLES E. FRENCH, previously with the Faigle Tool Co. The company's representation at present includes the INTERNATIONAL DETROLA CORPORATION, Machinery Division and Commercial Welding Division, Elkart, Ind., formerly known as the Foster Machine Co., and PROGRESSIVE INDUSTRIES Co. of Detroit. LOUIS LOWY, previously Detroit district sales manager for the National Tool Co., Cleveland, Ohio, has become associated with the new concern.

E. G. HARDIG, sales executive of the National Tool Co., Cleveland, Ohio, has been appointed sales representative of the organization in the Michigan territory. He has been connected with the company for fifteen years, and served as general sales manager during the war period. Mr. Hardig is opening an office at 417 Boulevard Bldg., Detroit, Mich., where he will carry on the business of





5 OPERATIONS - 33 Seconds

SUNICUT CUTTING OIL...

Used as Machine Lubricant and Cutting Lubricant on 8-Spindle Conomatic

For exacting metal-cutting requirements, the Sun Oil Company perfected "Sunicut," a clear, free-flowing, straight, cutting lubricant, produced by an exclusive process.

Here is a typical example of the fast, accurate work which is being done in hundreds of shops with Sunicut:

Machine: Cone Automatic Machine Co. 8-spindle Conomatic

Operation: Turning ($2\frac{1}{8}$ " Form-Tool), drilling and reaming ($3\frac{1}{8}$ " depth), knurling

Material: 1335 Hot rolled bar stock

Spindle Speed: 275 R.P.M.

Cycle: 33 seconds

Feed: (drilling and reaming) .007" per revolution

Machine lubricant: Sunicut

Cutting lubricant: Sunicut

Sunicut has high lubricating value and is an excellent dispenser of heat. It makes possible heavy cuts at high speed while maintaining accuracy and finish. Call the Sun Cutting Oil Engineer in your territory for full information, or write...

SUN OIL COMPANY • Philadelphia 3, Pa.
Sponsors of the Sunoco News-Voice of the Air—Lowell Thomas

SUN
—**SUNOCO**—

**INDUSTRIAL
PRODUCTS**

a manufacturers' agency, representing, in addition to the National Tool Co., concerns in several allied lines.

FOX ENGINEERING Co., Jackson, Mich., manufacturer of multiple-spindle drilling and tapping machines and hydraulic presses, announces the appointment of the BERT CARPENTER Co., 208 Hanna Bldg., Birmingham, Mich., as representative for the company in the territory comprising eastern Michigan, northern Ohio, and northeastern Indiana.

SERVICE MACHINERY Co., 231 Machinery Bldg., 2832 E. Grand Blvd., Detroit 11, Mich., is a new concern organized to specialize in machine tools, accessories, special machinery, and metal cleaning equipment. The founders of the company are WALTER B. DRAKE and PHILIP E. GLICK, formerly with the E. E. Wood Machinery Co.

DAVID B. GRANT has been appointed assistant sales manager of the Empire Tool Co., Detroit, Mich., upon his return from USNR. Before leaving for the naval service, he was Michigan sales director of the company.

RALPH C. BERG, formerly assistant plant superintendent of the Le Roi Co., Milwaukee 14, Wis., has been advanced to the position of production manager.

New England

KENNETH N. MACOMBER has been promoted from the position of chief service engineer of the Lapointe Machine Tool Co., Hudson, Mass., to that of chief engineer of the company. Prior to assuming his present position, Mr. Macomber was engaged in extensive war production and development work in the field of broaching. He has also done considerable lecturing on broaching.



Kenneth N. Macomber, Newly Appointed Chief Engineer of Lapointe Machine Tool Co.



James A. Wright, General Manager of Newly Organized Morse Twist Drill & Machine Co.

VAN NORMAN Co., Springfield, Mass., announces the purchase of substantially all the outstanding stock of the MORSE TWIST DRILL & MACHINE Co., New Bedford, Mass. The latter company will be operated as a separate corporation and will remain in New Bedford. The officers of the new management are as follows: President, JAMES Y. SCOTT; vice-president and general manager, JAMES A. WRIGHT; vice-president and assistant general manager, E. C. ADAMS; general sales manager, M. J. RAINEY; and treasurer, L. M. STANTON. Mr. Wright will have active charge of the operations of the Morse organization. He has been connected with the Van Norman Co. since 1934, joining that company in the capacity of assistant to the president. During World War II, Mr. Wright served as assistant to the director of the Machine Tool Section of the War Production Board in Washington. The new management contemplates further development of the present Morse line of drills, reamers, cutters, taps, dies, and special tools.

OWEN H. WENNING has been appointed sales manager of the Worcester Pressed Steel Co., Worcester 6, Mass. Mr. Wenning has been district representative of the company in New England since 1942, and also served as assistant sales manager. He was elected a director of the company at the last meeting of the board. CARTER C. HIGGINS, vice-president in charge of sales, will assume a new post in charge of public relations, industrial relations, and labor relations. CHARLES J. SAUTER has been appointed assistant sales manager.

NORMAN R. EKHOLM has been appointed abrasive engineer for the Pacific Northwest by the Norton Co., Worcester, Mass., succeeding J. E. STRACHAN, who takes over sales engineering work in the Worcester office. Mr. Ekholm's

headquarters will be in Seattle, Wash. He has been connected with the Norton Co. for over eleven years in the research laboratories and sales engineering work, and has recently returned from more than three years in the armed services. ELMER B. JONES has been appointed general traffic manager of the company, J. DOUGLAS DAWSON traffic manager of the Abrasive Division, and HUGH A. ALLEN traffic manager of the Machine Division. C. LAWTON RUCKER has been appointed resident manager of the Bauxite plant, Bauxite, Ark., of the Norton Co., replacing J. FELTON GIBBONS, who is retiring after thirty-three years of service. Mr. Gibbons will continue to act in an advisory capacity.

FERRACUTE MACHINE Co. and SUPER-SPEED PRESS CORPORATION, Bridgeton, N. J., announce the appointment of RICHARD S. BROWN, Wilbraham, Mass., as agent for these companies in New England (except Connecticut).

L. K. BURWELL has been made treasurer of the Eastern Machine Screw Corporation New Haven, Conn., to take the place of the late Thomas W. Ryley. Mr. Burwell will also fill the post of general manager. JOHN ROGERS has been made assistant treasurer and purchasing agent, and THOMAS W. HIGGINS became secretary.

HERMAN W. STEINKRAUS was elected chairman of the board of directors and re-elected president of the Bridgeport Brass Co., Bridgeport, Conn., at the recent annual meeting of the company. Mr. Steinkraus succeeds the late William R. Webster as chairman of the board.

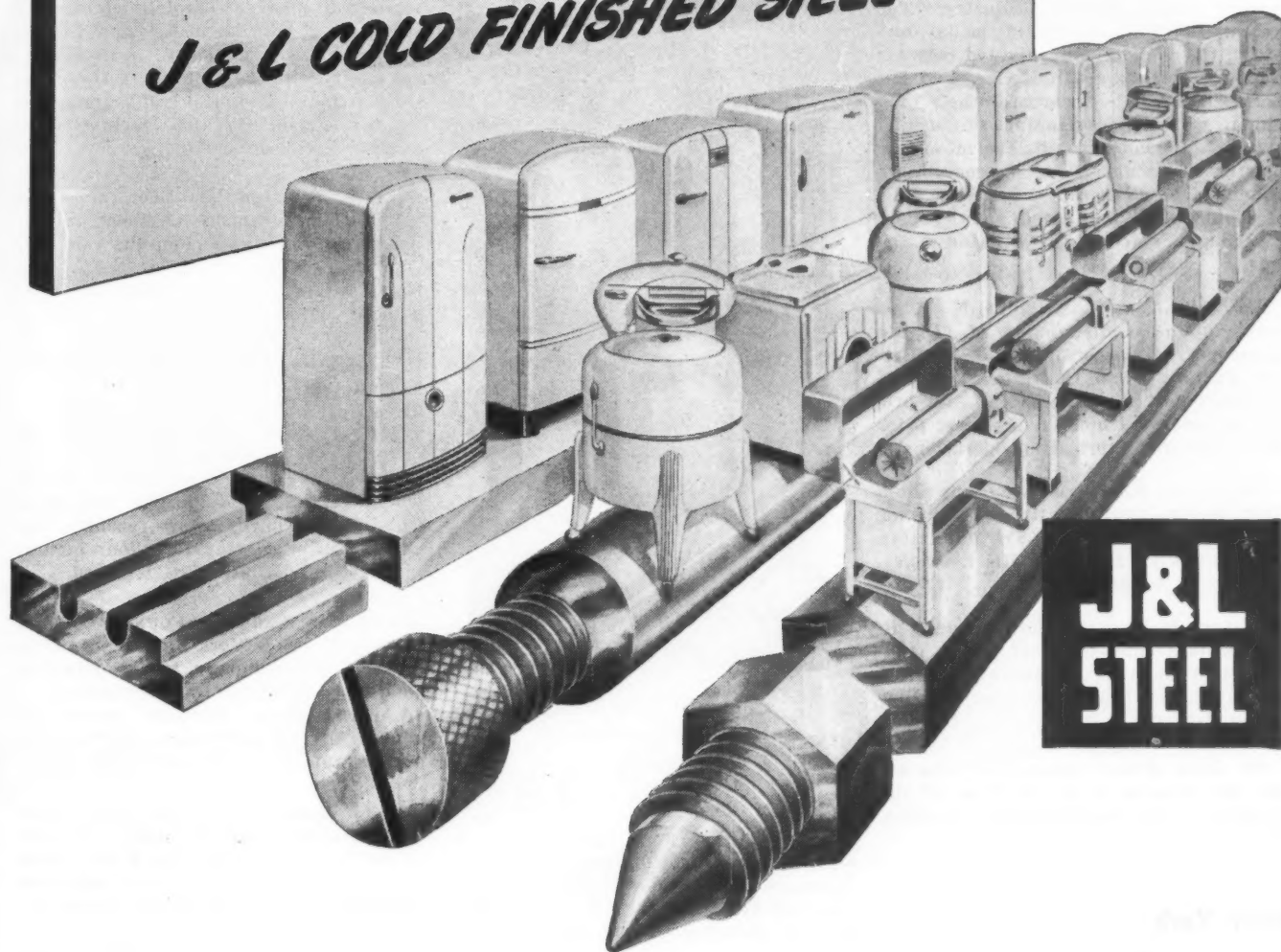
ATLAS COIL WINDERS, INC., has been established at 392 State St., Stamford, Conn., to provide coil users with a three-fold service—coil winding, manufacture of coil-winding equipment, and consultation on coil-winding problems.

CARBOLLOY COMPANY, INC., Detroit, Mich., has appointed the HAWLEY HARDWARE Co., 1120 Main St., Bridgeport, Conn., distributor of Carbolloy cemented-carbide products.

BROWN & SHARPE Mfg. Co., Providence, R. I., announces that the apprentice graduates of the company held a banquet and reunion at the Providence Biltmore Hotel on May 18. The principal speaker of the evening was JAMES E. MACLAREN (1918) of the firm of Buck & Hickman, Ltd., Birmingham, England, who spoke on his four years' experience in the British Ministry of Supply in the Midlands Region and on his work, just concluded, with the Control Commission in Germany. The toastmaster was WILLIAM H. STEWART (1917), B. & S. Cleveland representative.

LOVEJOY TOOL Co., Springfield, Vt., has appointed the following new representatives: L. A. BENSON Co., Inc., Baltimore 2, Md., and AUSTIN FORD LOGAN, Buffalo 2, N. Y.

*For Accurate Machine Parts
at Reduced Cost ... use
J & L COLD FINISHED STEEL*



Your machine parts can be made at lower cost from J&L Cold Finished steel because it is uniform. This means faster cutting speeds, less tool wear for you.

At J&L, steel for cold finishing is made expressly for that purpose. The required quality and grade are specifically outlined when the iron is made in the blast furnace, converted into steel at the Bessemers or

open-hearth furnaces and rolled into bars or special shapes. The long experience of Jones & Laughlin in the production of Cold Finished steel from the time the process was invented by them further assures the uniform quality of the product—a quality that will enable you to step up your production of accurate machine parts. Write for further information.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

New Jersey

VIRGIL E. MEHARG, superintendent of development of the Bakelite Corporation, Bound Brook, N. J., and PAUL D. ZOTTU, consulting electronic engineer, were presented jointly with the John Wesley Hyatt Award for outstanding achievement in the plastics industry at ceremonies following a dinner given recently at the Hotel Commodore in New York City, which was attended by more than 1500 members and guests of the Society of the Plastics Industry. The award consists of a gold medal and \$1000, the money being divided between the two recipients. Mr. Meharg and Mr. Zottu received the award for their individual work in developing the use of electronic heating of thermosetting plastic materials. Their research resulted in speeding up the curing time of molded and laminated plastics, and contributed much to the winning of the war.

EDGCOMB STEEL CO., Hillside, N. J., has been appointed distributor of "Liquid Envelope," a plastic film made by BERTER FINISHES AND COATINGS, INC., 268 Doremus Ave., Newark 5, N. J., for protecting steel and non-ferrous sheet prior to cutting and fabricating operations.

PHILIP G. NASE has been appointed New Jersey representative of ADVANCE PRESSURE CASTINGS, INC., 894 Manhattan Ave., Brooklyn 22, N. Y. His headquarters are at Caldwell, N. J.

WALTER R. FIDELIUS has been appointed assistant chief engineer of the Optimus Equipment Co., Matawan, N. J., manufacturer of metal washing and drying equipment.

ST. JOHN X-RAY LABORATORY announces the removal of all facilities of the company to its own building at Califon, N. J.

New York

PARKWAY FOUNDRY & MACHINE CO. has recently been formed by EMILE C. MATHIS, president of the Matam Corporation, Long Island City, N. Y., and AMICUS MOST, general manager of the old Parkway Foundry Co. of New York City. The new concern, which will produce non-ferrous castings by the sand, permanent mold, and centrifugal methods, is occupying a new plant at 59 Paidge Ave., Brooklyn, N. Y., which provides more than 120,000 square feet of floor area. Mr. Most will be the managing director of the concern. With the organization of the new company, the original Parkway Foundry Co. has been liquidated.

SAM TOUR & CO., INC., 44 Trinity Place, New York 6, N. Y., engineers, metallurgists, and consultants, announce that a department of mechanical engineering has been added to the company's chemical engineering, metal-finishing,

metallurgical engineering, and physical metallurgy facilities. E. V. CRANE, formerly consultant and chief of development engineering with the E. W. Bliss Co., is head of the new department, which will handle problems in the design of tools, dies, presses, special equipment, plant expansions and rearrangements, pilot plants, and complete plants for mass production.

CAPTAIN CARL J. LAMB, U.S.N.R., who has recently been released from active duty, has joined Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y., in the capacity of vice-president. Previous to his service with the Navy, Captain Lamb was engaged in consulting engi-



Captain Carl J. Lamb,
New Vice-president of
Hydropress, Inc.

neering work. For eight years, he served as a turbine engineer for the Westinghouse Electric Corporation, and also had held the position of New York district manager for the Sharples Corporation.

R. M. WILSON, JR., has joined the Technical Service Section of the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., as a welding engineer. J. S. VANICK, of the Development and Research Division, presented a paper entitled "Engineering Properties of Heat-Treated Cast Irons" before the Golden Jubilee Foundry Congress of the American Foundrymen's Association in Cleveland on May 10.

BENJAMIN O'SHEA has retired as chairman of the board of directors of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. He will continue as a director and a member of the executive committee. The office of the chairman of the board has been abolished with Mr. O'Shea's retirement. Mr. O'Shea has been associated with the corporation since its formation in 1917.

MAX J. SCHULTE is now associated with M. S. Chapell & Associates, 295 Madison Ave., New York 17, N. Y. He was previously vice-president and general manager of the Rawlplug Co. of New York City. Mr. Schulte's duties will be connected with the finding and placing of new products and the making of market surveys and manufacturing agreements.

DAVID GORDON & CO., INC., 29 Broadway, New York 6, N. Y., has been organized to provide complete engineering services to both domestic and foreign industry in the chemical and mechanical engineering field. SAMUEL G. ADAMS is chairman of the board; ALBERT DE CHIARA, president; and DAVID GORDON, executive vice-president.

J. W. SHEFFER has been appointed general improvement engineer of the American Car and Foundry Co., 30 Church St., New York 8, N. Y., and E. A. WATSON has been made assistant general improvement engineer. H. F. SCHWARTING has been appointed general electrical engineer, with headquarters at St. Louis, Mo.

JOHN F. CONROY, III, has resumed his position as president of the National Magnesium Corporation of Maryland, whose general offices are in New York City. Mr. Conroy was recently discharged after serving forty-four months in the United States Coast Guard.

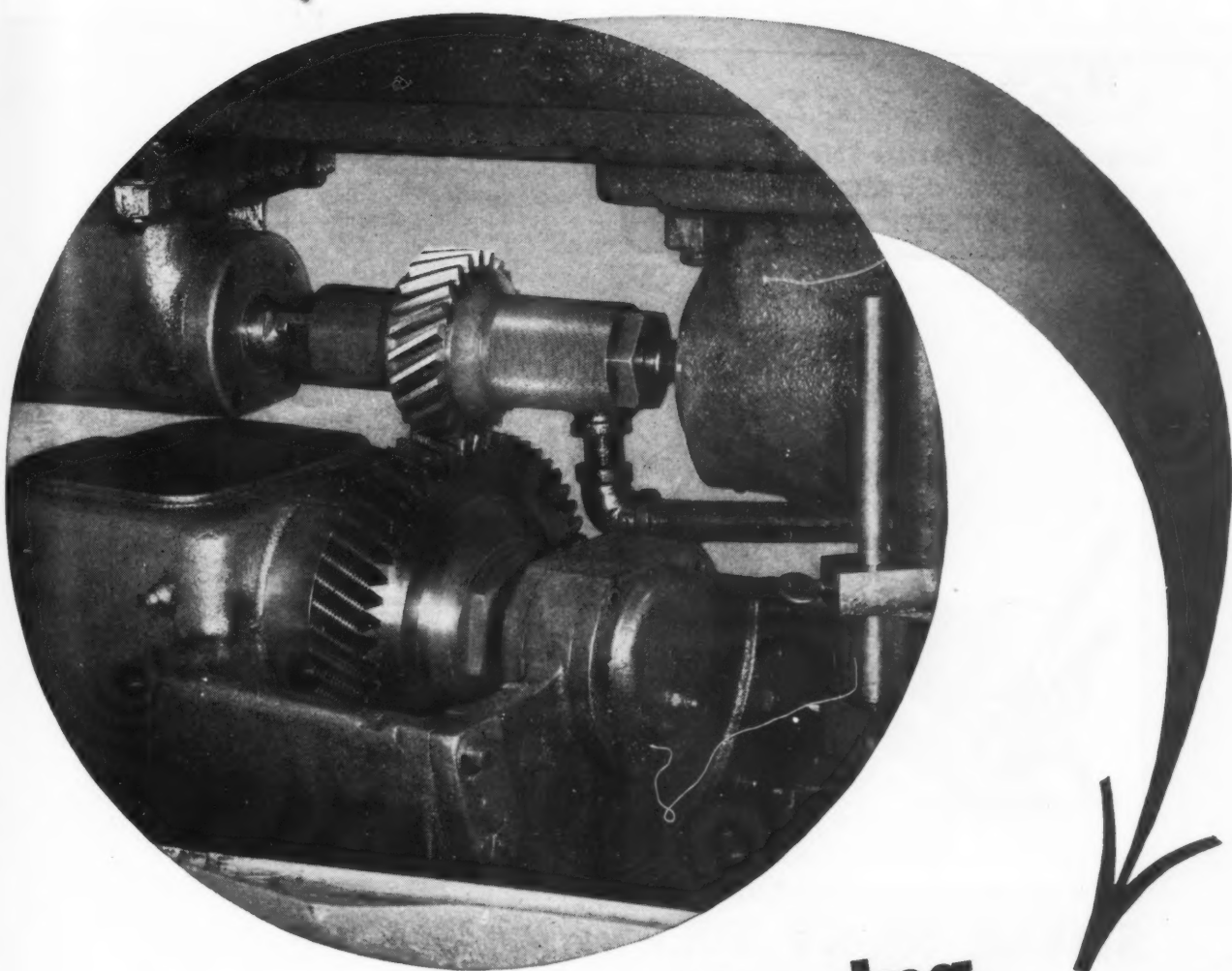
AMERICAN CAR AND FOUNDRY CO., 30 Church St., New York 8, N. Y., announces that the company is extending its welding activities by establishing a Welded Products Division which will concentrate on the design, development, and manufacture of weldments.

C. M. RHOADES, JR., has been named engineer with the Machinery Division of the General Electric Co., Schenectady, N. Y. H. W. POOLE has been appointed engineer with the Steel Mill Division.

R. W. STUEVE has been appointed general supervisor of labor relations for the American Car and Foundry Co., 30 Church St., New York 8, N. Y.

Ohio

ALFRED L. HELLER, SR., vice-president and general manager of Heller Brothers Co., Newcomerstown, Ohio, is retiring, after an association of over forty-eight years with the company, on account of ill health. Mr. Heller became connected with the parent concern at Newark, N. J., in 1898. He has served in all the major departments of the plant, and has participated in the many advances and developments that have taken place in the file and other tool industries. The management of the company has been taken over by LLOYD C. SMITH, who has been connected with the file industry for thirty-two years.



Underpass Curve-Shaving Boosts Gear Output Over 200% per machine

A large gear producer was getting 36 eight-pitch 24-tooth cast iron timing gears per hour on his gear finishing machines, removing .004 to .006 inches of stock, measured across pins.

When he installed a MICHIGAN underpass gear finisher in the line, however, output on the one underpass machine was more than total output on three of the other type—110 gears per hour.

Of interest is the fact that the underpass shaving cutter *curve-shaved* the gears at the same time that it finished them to within .0002 in. of spacing error and within .001 inch for eccentricity.

Curve-shaving—which crowns the faces of gear teeth—is built right into the underpass cutter, eliminating cam mechanisms, rocking motions, etc.

For complete information on MICHIGAN underpass gear finishing machines, ask for Bulletin #860A-44

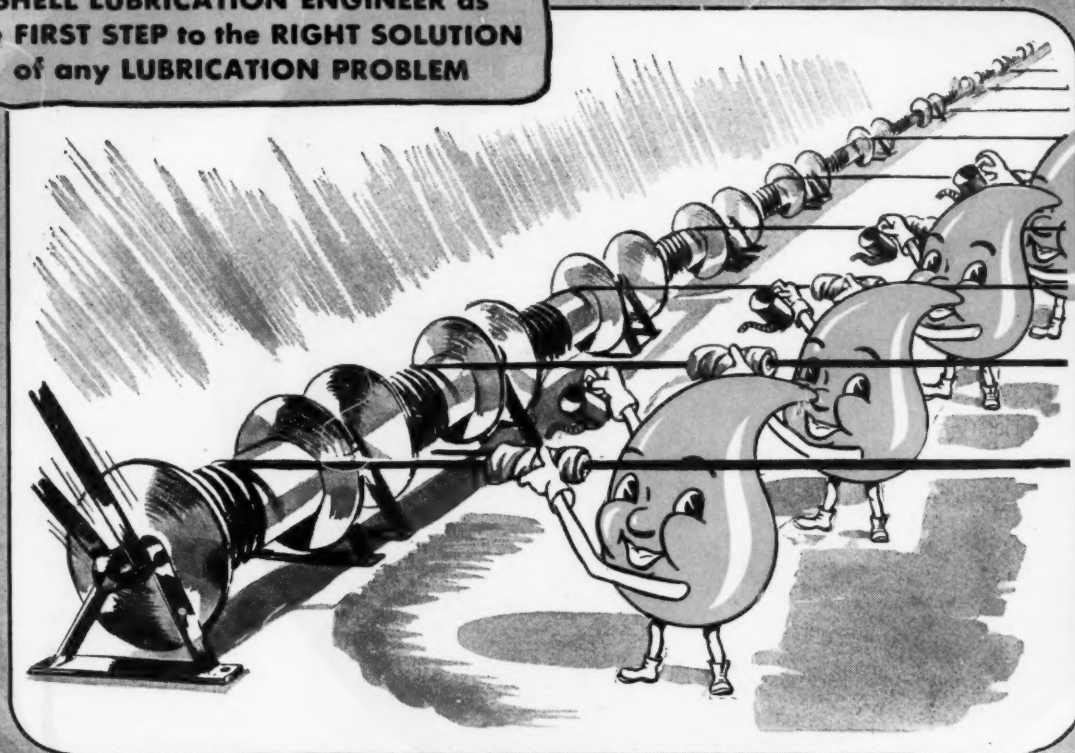


MICHIGAN TOOL COMPANY
7171 E. McNICHOLS ROAD
DETROIT 12, U. S. A.

MACHINERY, June, 1946—243



Call the
**SHELL LUBRICATION ENGINEER as
the FIRST STEP to the RIGHT SOLUTION
of any LUBRICATION PROBLEM**



SHELL RUST PREVENTIVE ... ELIMINATES GUMMING

PROBLEM: Steel wire, drawn to proper size for use by wire rope makers, was coated at steel mill for protection during shipment and storage. Use of a rust preventive was necessary, but rope makers complained that it gummed and clogged their wire rope machines.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem he recommended a change to a Shell Ensis product. This gave complete protection, and the gumming problem disappeared. More-

over, Shell Ensis Fluid is a petroleum product... dissolves harmlessly when the permanent lubricant is added to rope strands.

* * *

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for a copy of Shell's 40-page booklet on Rust Prevention. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL RUST PREVENTIVES
OILS... FLUIDS... COMPOUNDS





MACHINERY'S DATA SHEETS 563 and 564

DESIGNATIONS FOR MAGNESIUM ALLOYS

A.S.T.M. Magnesium Alloy Designation	The Dow Chemical Co. "Dowmetal" Alloy Designation	American Magnesium Corporation "AM" Alloy Designation	Nominal Percentage of the Main Alloying Constituents (Not Including Impurities)					
			Aluminum	Zinc	Manganese*	Silicon (Max.)	Tin	Magnesium
A8	A	241	8.5					Remainder
A10	G	240-59S	10.0					"
A12	B	246	12.0					"
AS100	K	230	10.0			1.0		"
AT35	D	65S	3.5				5.0	"
AZ31	FS	52S	3.0	1.0				"
AZ33	X	74S	3.0	3.0				"
AZ51	JS	54S	5.0	1.0				"
AZ61	J	57S	6.5	1.0				"
AZ63	H	265	6.0	3.0				"
AZ80	O	58S	8.5	0.5				"
AZ90	R	263	9.0	0.7				"
AZ92	C	260	9.0	2.0				"
AZ101	P	88S	10.0	1.0				"
M1	M	403-3S			1.5			"

Note: These designations are modified for controlled high-purity alloys, having a low percentage of nickel and iron impurities, by adding X to the A.S.T.M. designation (for example: AZ61X); by adding -1 to the Dow Chemical Co. designation (for example: J-1); and by preceding the American Magnesium Corporation designation with a C (for example: AM-C57S).

*In all alloys except M1, manganese is present as a required constituent in amounts varying from 0.1 to 0.2 per cent.

MACHINERY'S Data Sheet No. 563, June, 1946

Compiled by the Standards Committee
of the Magnesium Association

COLOR MARKING CODE FOR COMMONLY USED MAGNESIUM ALLOYS

Adopted by the Magnesium Association

A.S.T.M. Mag- nesium Alloy Design- ation	Color Marking*	Usual Forms									
		Sand Castings	Per- manent- Mold Castings	Die- Castings	Ingots	Billets	Rolling Slab	Extru- sions	Forgings	Sheet	Welding Wire
A8	Black	X			X						X
A10	Purple	X	X		X						X
A12	Yellow- Black	X			X						
AT35	Tan					X		X (Bar)	X		
AZ31	Red					X	X	X	X	X	X
AZ51	Brown					X	X			X	X
AZ61	Gray					X	X	X	X	X	X
AZ63	Green	X	X		X						X
AZ80	White					X		X	X		X
AZ90	Blue			X	X						
AZ92	Orange	X	X		X						X
AZ101	Red- Green	X			X						X
M1	Yellow	X			X	X	X	X	X	X	X

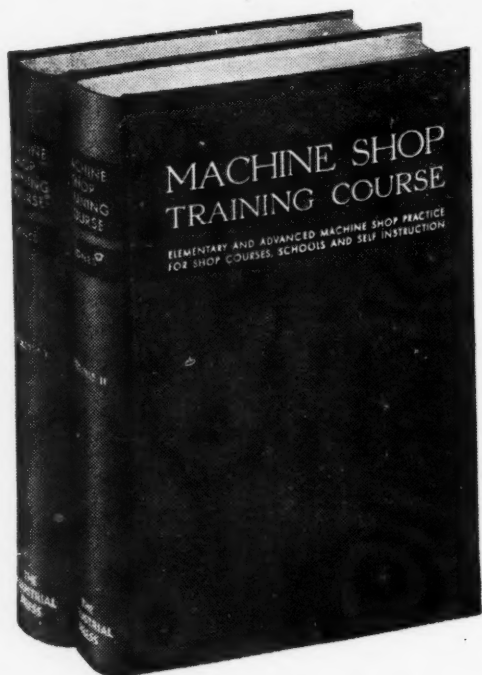
*An aluminum paint stripe is added to these colors for controlled-purity materials, which are indicated by the addition of the letter X to the A.S.T.M. designation.

MACHINERY'S Data Sheet No. 564, June, 1946

Compiled by the Standards Committee
of the Magnesium Association

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS



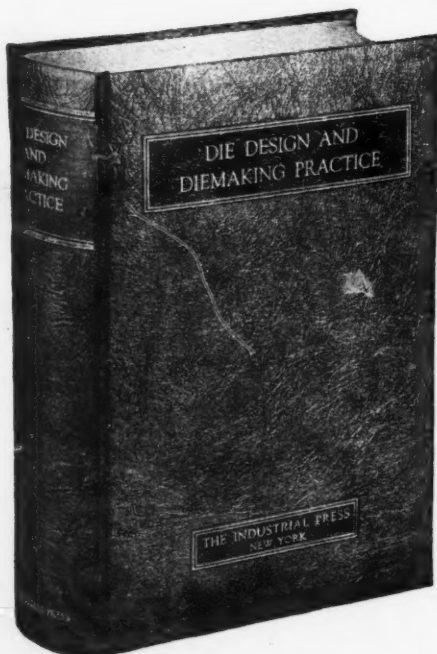
**Price \$6 Set—Payable \$2
with Order, \$2 Monthly**

This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains over 1100 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Die Design and Diemaking Practice



If you design, make or use dies for blanking, forming or drawing sheet-metal parts, here is a veritable die designer's and diemaker's bible. This die book presents not only descriptions and drawings of a tremendous variety of dies, but a vast amount of data representing a lot of boiled down and costly die experience. Dies of the same general classes are grouped together in chapters. The drawing dies have been placed into chapters according to the general shapes of the parts produced, to facilitate finding the type of die for producing a given shape. Price \$6—payable if desired \$2 with order and \$2 monthly for two months.

956 pages, 590 illustrations

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.



Oh
me
re
tic
at
in
an
tin
pr
ro
w
pa
tic
tin
w
pr

ag
&
m
he
w
di
en
po
L
po
an
H

A
O
Pr
el
C
W
vi
se
de
T
at
la

er
M
m
tu
ti
ch
of
co
vi
L
at
H
th

C
p
th
th
r
"
O
M
o
th
w

O
f
p

MONARCH MACHINE TOOL Co., Sidney, Ohio, recently held an Open House to mark the completion of the company's reconversion to the peacetime production of engine lathes. The occasion was attended by almost 8000 people, including employes and residents of the town and neighboring communities. A continuous program of entertainment was provided, and among the exhibits was a roomful of war trophies obtained by the war veterans of the company. While no part of the plant was in actual operation, demonstrations of high-speed cutting of metal on Monarch's new post-war lathes were a feature of the program.

E. C. WILSON, formerly district manager of the Detroit office of the Warner & Swasey Co., Cleveland, Ohio, has been made assistant sales manager, with headquarters in Cleveland. **I. T. WHITE** will take Mr. Wilson's place as Detroit district manager, and **ALEXANDER SELLERS, JR.**, will take Mr. White's previous position of Buffalo district manager. **L. M. COLE** has been promoted to the position of Southern district manager, and is succeeded by **H. M. WORSTELL** at Houston, Tex.

CLARENCE W. CUSTER, president of the American Stamping Co., of Cleveland, Ohio, has been elected president of the Pressed Metal Institute. Other newly elected officers include: Vice-president, **CARTER C. HIGGINS**, vice-president of Worcester Pressed Steel Co.; executive vice-president, **TOM J. SMITH, JR.**; and secretary-treasurer **J. J. BOEHM**, president of the Boehm Pressed Steel Co. The headquarters of the Institute are at 829 Union Commerce Bldg., Cleveland, Ohio.

WILLIAM L. DOLLE, president and general manager of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, manufacturer of lathes, recently returned from a European trip in connection with business associated with machine tool exports for the rehabilitation of production in a number of European countries. While in Europe, Mr. Dolle visited the Paris Fair, where one of Lodge & Shipley's new 2A Duomatic automatic lathes is being demonstrated. He also visited England, Switzerland, the Netherlands, and Belgium.

LOUIS POLK, president of the Sheffield Corporation, Dayton, Ohio, was recently presented with a certificate of appreciation by Colonel C. H. Deitrick, chief of the Cincinnati Ordnance District, representing the Secretary of War, for "outstanding service rendered to the Ordnance Department in time of war." Mr. Polk accepted the award on behalf of his fellow workers as a symbol of their efforts in meeting the country's war-time needs.

CAST METALS CORPORATION, Deshler, Ohio, has been organized as a jobbing foundry by **DOYLE M. CARRIN**, who is president and general manager.

Pennsylvania

SKF INDUSTRIES, INC., Philadelphia, Pa., announces the appointment of the following field representatives: **J. K. REDDING**, Philadelphia, Pa.; **L. E. JACOBS**, Buffalo, N. Y.; **W. S. CORNEILLE**, Milwaukee, Wis.; **F. O. HAMLET**, Chicago, Ill.; **G. E. MAYHEW**, Cleveland, Ohio; **B. J. FRAHER**, Detroit, Mich.; and **C. L. EBERLEIN**, Atlanta, Ga. It was also announced that **T. I. HALEY**, and **A. C. BARTH**, field representatives in the Portland and Dallas offices, respectively, had rejoined the organization after service in the armed forces.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces the reelection of all officers and the election of the following three new vice-presidents: **M. C. HARRIS**, production; **E. J. HANLEY**, finance; and **CLARK W. KING**. The office of vice-president in charge of manufacturing has been discontinued, and **FRANK B. LOUNSBERRY**, who formerly held that position, has been elected to the newly created office of vice-president in charge of methods and processes.

JAMES A. CLARK has joined the operations staff of the Vanadium-Alloys Steel Co., Latrobe, Pa. For the last four years he has served as captain in the Ordnance Department of the United States Army, filling the positions of assistant production superintendent and production metallurgist, respectively, at the Watervliet and Watertown Arsenals.

R. S. STOVER has been appointed supervisor of the Philadelphia-Washington district of Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis. His headquarters will be at the Wilfred Bldg., Philadelphia, Pa. Mr. Stover was previously district manager of the company's Washington, D. C., office. **ELMER E. WHITSON** will remain Philadelphia district manager.

RICHARD F. GARRETSON has been appointed eastern regional manager of the Ransome Machinery Co., Industrial Division, Dunellen, N. J., a subsidiary of the Worthington Pump and Machinery Corporation. Mr. Garretson will be in charge of sales of welding and work-positioning equipment, and will maintain offices at 2905 N. Broad St., Philadelphia, Pa.

HALL PLANETARY Co., Philadelphia, Pa., announces that, at the annual meeting of the board of directors, the following officers were elected: President, **PETER P-G HALL**; vice-president and secretary, **HENRY J. LEISNER**; and chairman of the board of directors, **GROSVENOR S. MCKEE**.

W. C. LANDIS was elected vice-president in charge of manufacturing of the Westinghouse Air Brake Co., Wilmerding, Pa., and of the Union Switch & Signal Co., Swissvale, Pa., at a recent meeting of the board of directors. He was formerly works manager of both plants.

GEORGE PEARLMAN has been made production manager of the Piad Powder Metallurgy Co., 6635 Kelly St., Pittsburgh 6, Pa. **LLOYD KRAMER** has joined the organization in the capacity of metallurgist.

R. W. BIGGS has been named works manager of the Ambridge, Pa., plant of the National Electric Products Corporation, succeeding **NEIL C. LAMONT**, who has retired.

MAJOR JOSEPH P. SOMERS, who was recently discharged from the Army, has joined the Philadelphia sales office of the Wyckoff Steel Co., Pittsburgh, Pa.

EMIL ROUGRAFF has been appointed works manager of the Thomas Machine Mfg. Co., Pittsburgh, Pa. He was formerly manager of the contract department.

J. J. SCHMIDT has been appointed superintendent of the Landis Machine Co., Waynesboro, Pa., succeeding **J. G. HARPER**.

Coming Events

JUNE 2-7 — Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at French Lick Springs Hotel, French Lick Springs, Ind. **John A. C. Warner**, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

JUNE 3-6—Aviation Division Meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Los Angeles, Calif. **Clarence E. Davies**, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 12-15—Oil and Gas Power meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Milwaukee, Wis. **Clarence E. Davies**, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 17—First technical session of the MACHINE DESIGN GROUP of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Statler, Detroit, Mich. Chairman, Sub-committee on Publicity, Machine Design Group, **Colin Carmichael**, Associate Editor, "Machine Design," Penton Bldg., Cleveland 13, Ohio.

JUNE 17-20 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Detroit, Mich. **Clarence E. Davies**, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 20-22 — Conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at Atlantic City. **W. Lane Witt**, president and general manager, 100 E. Ohio St., Chicago 11, Ill.

JUNE 21-22—Applied Mechanics meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Buffalo, N. Y. **Clarence**

E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 24-26—Spring meeting of the **SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS** at the Hotel Statler, Buffalo, N. Y., including a symposium on the fatigue of manufactured parts, under joint sponsorship with the American Society for Testing Materials. Secretary-treasurer, W. M. Murray, Central Square Station, Cambridge 39, Mass.

JUNE 24-28—Forty-ninth annual meeting of the **AMERICAN SOCIETY FOR TESTING MATERIALS** at the Hotel Statler, Buffalo, N. Y., in conjunction with the seventh exhibit of testing apparatus and related equipment. C. L. Warwick, executive secretary, 260 S. Broad St., Philadelphia 2, Pa.

AUGUST 22-24—National West Coast Transportation and Maintenance Meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the New Washington Hotel, Seattle, Wash. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 11-12—National Tractor Meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 16-20—1946 Exhibit and conference of the **INSTRUMENT SOCIETY OF AMERICA** at the William Penn Hotel in Pittsburgh, Pa. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

SEPTEMBER 18-19—Fall meeting of the **AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION** at the Homestead, Hot Springs, Va. Executive secretary, Thomas A. Fernley, Jr., 505 Arch St., Philadelphia 6, Pa.

SEPTEMBER 30-OCTOBER 3—Fall meeting of the **AMERICAN SOCIETY OF MECHANICAL ENGINEERS** at Boston, Mass. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

OCTOBER 3-5—Aeronautic meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary, and general manager, 29 W. 39th St., New York 18, N. Y.

OCTOBER 16-17—National Transportation and Maintenance Meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the Hotel Knickerbocker, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 7-8—National Fuels and Lubricants Meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the Mayo Hotel, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 17-22—Annual meeting of the **AMERICAN WELDING SOCIETY** at Atlantic City, N. J., in conjunction with

the **National Metal Congress and Exposition**. For further information, address **American Welding Society**, 33 W. 39th St., New York 18, N. Y.

NOVEMBER 18-22—**NATIONAL METAL CONGRESS AND EXPOSITION** in Atlantic City, N. J., under the auspices of the **American Society for Metals**. Managing director, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

DECEMBER 2-4—National Air Transport Engineering Meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the Edgewater Beach Hotel, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 2-6—Annual meeting of the **AMERICAN SOCIETY OF MECHANICAL ENGINEERS** in New York City. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.



John J. O'Brien

John J. O'Brien, who, with his twin brother, Miles, founded the South Bend Lathe Works, South Bend, Ind., died on April 24 at his home in South Bend after an illness of several weeks. He would have been seventy-four years old on May 10. Mr. O'Brien had been in declining health for several years, and retired from active business duties a few months ago. His brother died ten years previously.

The twin brothers were born in County Cork, Ireland, on May 10, 1872. They came to America with their parents when they were two years old and settled in New Britain, Conn. When they had finished high school, they went to work in manufacturing plants to learn the diemaking trade, Miles starting with the American Graphophone Co. in Bridgeport, and John with the Stanley Works in New Britain. Subsequently, John O'Brien joined a large machinery sales house in Chicago, selling machine tools. In November, 1906, he and his brother started a small machine and tool company at Washington Ave. and Johnson St. in South Bend, which has grown through the years into a concern employing several hundred persons and manufacturing lathes that are distributed throughout the world.

Mr. O'Brien is survived by his wife, two daughters, and a son.

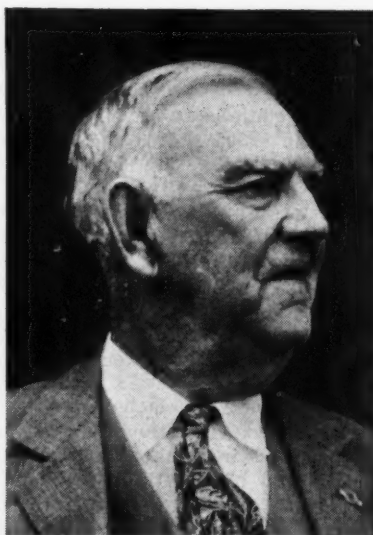
JOHN E. KORDENBROCK, a demonstrator of machine tools with the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, for forty-seven years, died of a heart ailment on April 26 at his home in Cincinnati, aged seventy-two years. Mr. Kordenbrock was born in Kentucky, and went to Cincinnati almost fifty years ago. In 1899 he was employed by the Lodge & Shipley Machine Tool Co. as a demonstrator, in which capacity he served until his death. During his long career he covered an extensive territory and made many friends in the industry throughout the country. He was responsible for the development of numerous

Obituaries

John J. Prindiville

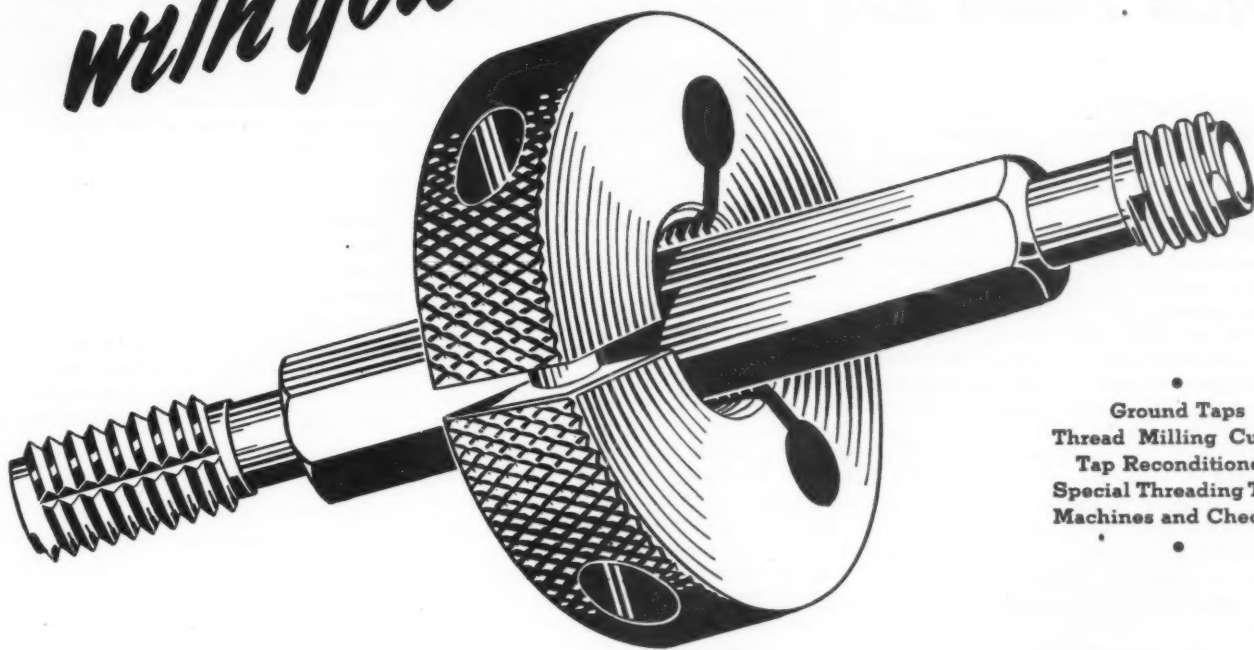
John J. Prindiville, president of the Lapointe Machine Tool Co., of Hudson, Mass., and head of the International Engineering Works, Framingham, Mass., died in Boston, on April 30, at the age of seventy-five. Mr. Prindiville was born in Palmer, Mass., and entered the construction business at an early age. As president and treasurer of the Lapointe Machine Tool Co. since 1914, he guided the business through two wars, increased its volume many times, and was the innovator of much modern broaching equipment.

Active in business affairs throughout New England, Mr. Prindiville was founder and director of the Framingham Trust Co., in addition to his large industrial enterprises.



John J. Prindiville

*Don't get caught
with your tolerances down*



•
Ground Taps
Thread Milling Cutters
Tap Reconditioners
Special Threading Tools
Machines and Checkers
•

BIRMINGHAM, Ala....Birmingham 7-1017
BUFFALO 2, N. Y.....GRant 6601
CHICAGO 12, Ill.....KEdsie 3170
CINCINNATI 2, O.....MAin 2544
CLEVELAND 13, O.....CHerry 3520
DAYTON 2, O.....FULton 6161
DENVER 2, Colo.....KEystone 7229
DETROIT 11, Mich.....MAdison 0260
FLINT, Mich.....Flint 4-3661
HOUSTON, Tex.....CApitol 5487
INDIANAPOLIS 9, Ind....FRanklin 2456
LOS ANGELES, Calif.....ADams 1-4381
MILWAUKEE 2, Wisc.....DAily 4256
MINNEAPOLIS, Minn.....MAin 1488
MUSKEGON, Mich.....Muskegon 248
NASHVILLE 6, Tenn....Nashville 6-3647
NEWARK 2, N. J.....MArket 3-1493
PITTSBURGH 19, Pa.....ATlantic 3011
ROCKFORD, Ill.....MAin 2243
ST. LOUIS 1, Mo.....CEntral 4435
SAN FRANCISCO, Calif...DOuglas 7711
SOUTH BEND 3, Ind...South Bend 3-0009
SYRACUSE 9, N. Y.....SYracuse 8-1462
TOLEDO 4, O.....GARfield 8302
MONTREAL, Canada.....MAin 5346
TORONTO, Canada.....WAverly 2688
WINDSOR, Canada.....Windsor 4-9229

History shows that industry never turns backward. This applies to tolerances, also. During World War II, thousandths and half thousandths shrank to one or two-tenths. Peace-time industry, in all likelihood, will continue to work to these—and even closer—tolerances.

You can obtain from our stock, for immediate delivery thread plug and ring gages, which will assure you that your threads are being held to today's close tolerances.

The Detroit Tap Representative in your area will be glad to advise you of the number of each size of gage in stock at any given time. Give him a call today.

DETROIT

TAP & TOOL CO.

8432 BUTLER AVENUE DETROIT 11, U. S. A.

improvements in lathe operations. Mr. Kordenbrock is survived by a daughter and three sons.

THOMAS W. RILEY, treasurer of the Eastern Machine Screw Corporation, New Haven, Conn., died on March 24 of a heart ailment at his home in West Haven, Conn. Mr. Riley became connected with the Eastern Machine Screw

Corporation in 1921 and was elected treasurer that same year. He also served as secretary of the company from 1936 to 1942. Mr. Riley was a director of the corporation and also acted as purchasing agent.

GEORGE A. LINDBLADE, secretary and treasurer of the Sundstrand Machine Tool Co., Rockford, Ill., died on April 27.

New Books and Publications

CHANGING THE SHAPE OF METALS WITH AN ENGINE LATHE. 160 pages, 9 by 12 inches; over 500 charts, photographs, and drawings. Published by the Shell Oil Co., Inc., 50 W. 50th St., New York 20, N. Y. Price, \$7.50.

The object of this book is to present a clear picture of the work done by lathes, accompanied by illustrations that explain methods and results, and the types of lathes and tools used. The text has been prepared on the assumption that the reader knows how to operate a lathe or will be told how by competent instructions. Thus, the book is intended to supplement, and not to replace, existing training programs on lathe operation. While the book is simple enough for beginners, it contains material of value to experienced machinists, instructors, and shop superintendents.

First, the fundamentals of machine tool design and performance are outlined and the basic characteristics of lathe construction and operation are explained. Next, the book discusses the fundamental features of different lathe operations, such as turning, boring, facing, and threading, with particular emphasis on why they are performed as they are. Such fixed factors as machine design and tool shape and such operating factors as tool setting, depth of cut, speed of work-piece, and rate of tool feed are briefly explained. In addition, the characteristics of the metal being cut and the use of cutting oils in the light of their effect on the finished job are dealt with. A liberal use of photographs and charts clarifies the text. The book is available for educational activities at special quantity rates.

JOB EVALUATION METHODS. By Charles Walter Lytle. 329 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, \$6.

In both the operating and industrial relations programs of modern plants, job evaluation occupies an important place, and management and workers alike have much to gain from an understanding of the subject. This book endeavors to explain clearly what job evaluation is, the purpose of it, and the methods and techniques used in setting up a job evaluating plan. Rather than

describing specific plans the author has attempted to set forth the fundamental principles of job evaluation, so that those who wish to institute plans can make them to suit their own needs.

An idea of the treatment will be obtained from the following list of chapter headings: A Minor Function Becomes a Major One; Determining Policies and Organizing; Methods and Techniques; Choosing Job Characteristics; Selling the Plan; Setting Up Measuring Scales; Job Analysis—Describing and Specifying; Job Analysis—Classifying; Locality Surveys—Setting the General Wage Level; Building the Rate Structure; Operating and Adjusting; Merit Rating; Applying Evaluation to Office and Supervisory Positions.

Many forms, tabulations, charts presenting graphically the set-up of rating curves, and illustrative case material from successful installations are included to aid in organizing a system.

A TREATISE ON MILLING AND MILLING MACHINES. 182 pages, 6 by 9 inches. Profusely illustrated. Published by the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Price, \$1, prepaid.

This is the first section of a treatise on milling and milling machines, which is now in its third edition. It covers milling machines, accessories, milling cutters, cutting materials, and cutter sharpening. Like the former editions, of which many thousand copies have served students and teachers, as well as machine operators and engineers, this edition describes in a comprehensive manner the functions and operations of milling machines, as well as the cutting tools used for milling operations. Typical examples of milling, illustrating actual equipment installed in manufacturing plants, suggest the right kind of fixtures and work chucking devices, as well as the most economical cycle of operations.

The chapters on materials for cutting tools and the sizes, styles, and shapes of milling cutters are based on the latest milling cutter research, which for many years has been one of the major functions of the research department of the Cincinnati Milling Machine Co. The material in the book, representing the combined experience of the engineer-

ing staff of the company, was compiled by Mario Martellotti, research engineer with the company.

THE METALLURGY OF STEEL CASTINGS. By Charles W. Briggs. 633 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, \$6.50.

This book has been prepared in response to the need for a single source of reference containing detailed information on technical and metallurgical control in the production of steel castings. The data presented should provide operating men, workers, and apprentices in the industry, buyers of steel castings, design engineers, metallurgists of other industries, and students with a clear understanding of the manufacture of high-quality steel castings. It includes an account of recent research, such as the analysis of freezing by directional solidification on rates of freezing, and discusses, among other subjects, gases, deoxidation and inclusions; tapping and pouring; properties of liquid cast steel; gates and risers; hot-tear formation; steel molding sands and cores; casting defects; cleaning, chipping, and grinding of steel castings; heat-treatment; welding of steel castings; inspection, etc.

INTRODUCTION TO X-RAY METALLOGRAPHY. By A. Taylor. 400 pages, 6 1/4 by 9 3/4 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, \$7.50.

X-ray analysis is proving itself an essential tool in metallurgical research. It is being increasingly employed to supplement the commonly used thermal and microscopic methods of studying the physical characteristics of metals and alloys. Metallurgists and others interested in this rapidly expanding field will find in this book information that will provide a thorough grounding in the subject and discussion of many of the problems involved in their work. The subjects treated include the choice of an X-ray tube; calculation of interatomic distances; crystal structures of metals; measurement of grain size; application of X-rays to the study of refractory materials; radiography of welds; and many other phases.

HOT-ROLLED CARBON-STEEL STRUCTURAL SHAPES. 21 pages, 6 by 9 inches. Published by the United States Department of Commerce as Simplified Practice Recommendation R216-46. Obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 10 cents.

METAL-CUTTING BAND SAWS. 10 pages, 6 by 9 inches. Published by the United States Department of Commerce as Simplified Practice Recommendation R214-45 of the Bureau of Standards. Obtainable through the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 5 cents.

MACHINING DATA ON PLASTICS

10. MACHINE ENGRAVING

(PART THREE OF THREE PARTS)

This is the tenth in a series of messages designed to better your knowledge of the phenolics—the most versatile of all plastics... the type of plastics which Durez has specialized in producing for the past quarter century.

Because the cost of machine engraving runs higher than other methods of marking, it is only used occasionally. However, there are certain definite applications such as precision work calling for close dimensional accuracy, where it is very necessary.

Special Engraving Machine

The machine engraving of molded phenolic plastic parts is accomplished by means of a mechanical arrangement on an accurate precision built machine using rotary cutters. These machines are equipped with adjustable pantographic ratios.

For engraving numerals, lettering, or specially designed monograms, an enlarged master template is set up in the tracer holder. The tracer on the pantographic arm is followed or guided around the template causing the cutter to follow the same form and reproducing the desired engraving in a reduced size.

High speed steel cutting tools can be used for small quantities of general-purpose, cotton- or rag-filled plastic

materials. However, tungsten carbide tipped tools are most satisfactory, especially on mineral-filled materials which are of an abrasive nature.

Cutter Speeds

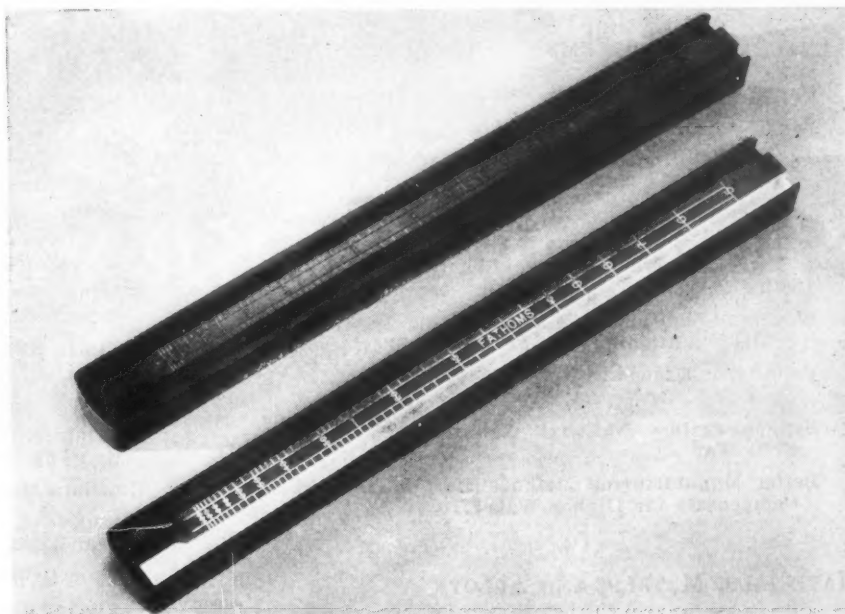
In all cases, the cutter should be operated at the maximum possible speed. The recommended peripheral speed for phenolic materials is 300 to 600 feet per minute.

Colored Lettering

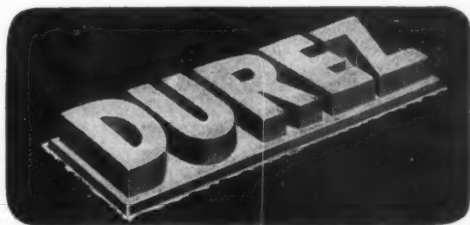
The filling of depressed lettering to obtain contrasting colors is accomplished by means of brushing lacquer or paint into the depressions. In doing this, a certain amount of paint will be deposited on the surrounding surface of the molded part. This, however, may be removed with very little difficulty by semi-drying the paint and wiping the high surface with a cloth saturated with a suitable solvent. To obtain a superior lustrous finish, this surface may be polished on a clean buffing wheel.

Free Booklet

Write for free, authoritative booklet "Machining Data on Phenolic Plastics." You will find it most helpful because it covers all the standard phenolic plastic machining operations encountered in the average plant. No obligation, of course. Durez Plastics & Chemicals, Inc., 46 Walck Road, N. Tonawanda, N. Y.



This before and after photo illustrates a molded Durez "Fathom Meter" in which depressed graduations and lettering have been molded and filled with white paint.



PHENOLIC
RESINS

MOLDING COMPOUNDS

INDUSTRIAL RESINS

OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

Classified Contents of This Number

DESIGN, FIXTURE AND TOOL

- Equipment Designed to Facilitate the Use of Diamond Tools—*By Dr. G. Schlesinger and Dr. D. F. Galloway* 179
- Drill Jig for Swivel Bracket..... 189
- Simplified Practice Recommendation for Nuts and Bolts 192

DESIGN, MACHINE

- The Hydraulic Circuit in Bending Machines—*By E. J. DeWitt and Harry S. Nachman*..... 149
- Utilizing Residual Forming Stresses in Flat Steel Springs—*By W. C. Troy*..... 152
- Present-Day Motor Drives and Other Electrical Equipment for Machine Tools—*By G. A. Caldwell* 164
- Automatic Hopper Feeds for Small Cylindrical Parts *By E. W. Duston*..... 193
- Electric Motors of Light Weight per Horsepower... 194

EDUCATION, TRADE AND ENGINEERING

- Correspondence Course in Mechanics..... 168
- Training Supervisors in Human Relations..... 173

MANAGEMENT PROBLEMS

- Our Foreign Trade can be Stifled by Unwise Policies 163
- Suggested Industrial Legislation 177
- There are Unlimited Possibilities for Industrial Progress 186
- Why Does Government Hamper an Industry Vital to Prosperity? 186
- A User Enumerates Future Requirements for Machine Tools 187
- Working Conditions in a Machine Shop Improved by Sound-Conditioning—*By Francis A. Westbrook*... 188
- Validity of Exaggerated Sales Statements—*By Leo T. Parker*..... 192
- Strikes against National Welfare are, in Effect, Civil War 194
- Better Manufacturing Methods Must be Devised to Compensate for Higher Wages..... 197

MATERIALS, METALS, AND ALLOYS

- Indium—A Metal Acquiring Industrial Significance. 151
- New Applications of Molybdenum..... 167
- Silicone Insulation for High Temperatures..... 173
- Results of Ten-Year Aging Test of Neoprene..... 176
- High Impact Values of Steel Castings for Use at Extremely Low Temperatures 190
- High-Strength Castings 192
- High-Strength Wire 197
- Prehardened Die Steel for Use in Zinc-Alloy Die-Casting 198
- New General Electric Plastic Shows Improved Qualities in Heat Test..... 198
- Heavy-Duty Floor Cleaner Developed for Cement and Tile Floors 198

MOTION PICTURES, EDUCATIONAL

- Film for Engineering Classes..... 151
- Film on Industrial Air Power..... 168
- "This is Resistance Welding"—a New General Electric Motion Picture 182

NEWS OF INDUSTRY

- Automotive Profits Deeply Cut..... 163
- Gear Industry Reports Increase in Sales..... 171
- The Automotive Industry Stages Fifty-Year Celebration 175
- Engineering News 184
- Wheelock, Lovejoy & Co. Celebrate Hundredth Anniversary 189
- News of the Industry..... 238

SHOP PRACTICE

- The Forging of Magnesium—*By Arnold L. Rustay and Franklin B. Rote*..... 141
- Surface Grinding with Cylinder and Segmental Wheels—*By J. C. Arndt and W. S. Hollowell*..... 158
- Cutting Compounds for Machining Aluminum Alloys 168
- Safe Loading Chart Improves Truck Maintenance.. 168
- Friction Band Sawing of Hard Materials—*By Charles H. Wick*..... 169
- Some Considerations in Internal Grinding..... 172
- Coated Abrasives Solve Many Reconversion Metal-Finishing Problems 174
- Some Points to be Considered in Selecting Drawing Lubricants 176
- Honing Wheel Facilitates Finish-Sharpener of Carbide Tools 176
- Portable Steam Cleaning Unit..... 177
- Carbide Tool Resists Severe Impact on Maintenance Job 181
- Multiple Milling of Tool Shanks Increases Production—*By Earl Weaver* 183
- Standard Grays for Engineering Equipment..... 192
- Methods of Locating and Boring Shaft Holes in Gear-Boxes 195
- Jig for Drilling Sleeve Flanges..... 196
- Centering Device Used in Positioning Work Drilled in Lathe 196
- Milled Parallels for Holding Work on Magnetic Table of Grinding Machine—*By Frank Horack*... 197
- Shop Equipment News 199

WELDING AND SOLDERING

- Self-Propelled Turning Rolls Facilitate Automatic Welding of Tanks 167
- Automatic Arrangement for Silver-Soldering Refrigerator or Condenser Coils 178
- Lincoln Foundation Announces \$200,000 Arc-Welding Award Program 183